LAKE MICHIGAN

2007 Creel Survey Report

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EXECUTIVE SUMMARY

- A nonuniform probability creel survey was conducted on Lake Michigan from April 1 to October 31, 2007 and three Lake Michigan tributaries from March 1 to March 31, 2007 and July 1 to December 31, 2007. The survey covered sport fishing by shore anglers and boat anglers (including chartered trips) from several Indiana ports (Washington Park and Trail Creek Marina, Michigan City; numerous private ramps and slips on Burns Waterway, Portage; Pastrick Marina, East Chicago; Whihala Beach County Park boat launch, Whiting, and Hammond Marina, Hammond) and stream anglers on three tributaries of Lake Michigan (Trail Creek, LaPorte County; East Branch of the Little Calumet River, Porter County, and Salt Creek, Porter County).

- Due to Indiana's close proximity to neighboring states' borders and the migratory nature of trout and salmon, many boat fishing trips were conducted in other states' waters. The estimates provided represent estimates of fish returned to Indiana ports. Because a subset of all fishing locations was surveyed, the creel survey cannot yield estimates of total harvest and effort for southern Lake Michigan. Rather, the creel data is used to monitor trends in the Lake Michigan fishery.

- During the survey period anglers fished an estimated 294,987 hours, which was 4% higher than the estimated number of hours anglers fished in 2006. Seventy-one percent of the fishing hours came from boat anglers.

- Estimated total catch from the combined fisheries was 245,984 fish representing twenty-six fish species, an estimated 29% lower compared to total catch observed during 2006. Yellow perch dominated the 2007 catch, comprising 66% of the total. The boat fishery, including chartered trips, dominated the catch accounting for 87% of the total.

- Chinook salmon, steelhead trout, brown trout, and lake trout catch rates (CPUE) increased compared to the prior fishing season; whereas coho salmon and yellow perch catch rates declined. For Chinook salmon, CPUE was the highest observed from the prior ten-year period. Coho salmon CPUE, however, was the lowest recorded from the ten-year period. Comparing 2007 catch rates with their long-term averages, both coho salmon and yellow perch anglers caught fish at below-average rates.

- Bass, a near-shore species, continues to play an important role in the Lake Michigan boat and shore fisheries. The 2007 catch and effort were both higher than observed in 2006. The majority of fishing occurred from boats, accounting for 87% of the effort and 90% of the catch. Most bass caught were released; only 2% of the total catch was harvested.

- Anglers from 62 Indiana counties fished Lake Michigan and it's tributaries in 2007. The majority of anglers interviewed were from Lake County, accounting for 26% of all anglers. LaPorte County, Porter County, and out-of-state residents followed, with 23%, 17%, and 16% of the anglers, respectively. Other counties with frequent use included St. Joseph County, Elkhart County, Allen County, and Marion County. Anglers from thirteen different states were represented in the survey, with the majority of these anglers coming from Illinois (85%); primarily Cook and Will Counties.

- The majority of anglers felt it was "Very Important" to "Important" to have salmonine species and yellow perch in Lake Michigan. Anglers targeting trout and salmon were "Somewhat Satisfied" to "Extremely Satisfied" with the fishery; however, 30% of boat and shore anglers and 37% of stream anglers were "Less Than Satisfied" with the brown trout fishery. Fifty percent of the shore anglers and 20% of the boat anglers were "Less Than Satisfied" with the lake trout fishery. For yellow perch, only 7% of the perch parties gave a low satisfaction rating.

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INTRODUCTION

Since 1969, the Indiana Department of Natural Resources (IDNR) has stocked trout and salmon along the Indiana shoreline of Lake Michigan to enhance the sport fishery. The area stocked extends from Whiting, Indiana to Michigan City, Indiana, and includes sites along Trail Creek, the East Branch of the Little Calumet River, and the St. Joseph River. Trout and salmon are reared at Mixsawbah State Fish Hatchery in Walkerton, Indiana and Bodine State Fish Hatchery in Mishawaka, Indiana. From 1995 to 2007, the number of trout and salmon stocked in Indiana waters of Lake Michigan by the IDNR has averaged 1.2 million fish per year (Table 1, Figure 2). Lake-wide, an annual average of 13.4 million fingerling and yearling trout and salmon have been stocked into Lake Michigan since 1995 (Table 2).

To effectively manage Lake Michigan, biologists need to annually evaluate what is occurring within the fishery. One evaluation technique is the creel survey, utilized to gauge angler use and harvest on a body of water. These data are collected and used to assess the quality and quantity of a fishery, and provide information to evaluate stocking and fishing regulations. Since 1966, the Indiana Department of Natural Resources Division of Fish and Wildlife (DFW) has collected sport harvest data on Indiana's portion of Lake Michigan (McReynolds 1966).

The objective of the Indiana Lake Michigan creel survey is to evaluate sport fishing effort, fish catch by species, angler preferences and angler attitudes from southern Lake Michigan and tributaries as part of the DFW Work Plan 300FW1F10D40504. Due to limitations in site access (e.g. access restrictions to industrial areas based upon the National Threat Advisory level) and budgetary restrictions, however, the creel survey can only provide an index of fishing catch, harvest, and effort along Lake Michigan and its tributaries. These data assist the DFW Lake Michigan fishery management efforts in providing valuable trend information concerning the status of sport fish in Lake Michigan and provides the sport community with catch and effort statistics.

STUDY SITE

Indiana's portion of Lake Michigan is the smallest of the four states bordering the Lake (approximately 1% of the Lake Michigan area), encompassing about 43 miles of shoreline (224 square miles). Most of the area is highly developed and heavily industrialized, with the exception of the Dunes National Lakeshore and the Indiana Dunes State Park (Figure 1).

Several lakefront marinas provide boat and shore access, including: Washington Park and Trail Creek Marina, Michigan City; one municipal ramp and several private ramps along Burns Waterway, Portage; Robert A. Pastrick Marina, East Chicago; Lake County Parks and Recreation Whihala Beach boat launch, Whiting and Hammond Marina, Hammond. Three coal-fired power plants are also located along the shoreline, including the Northern Indiana Public Service Company (NIPSCO) Michigan City Generating Station, Michigan City; NIPSCO Bailly Generating Station, Burns Harbor and the Dominion State Line Power Plant, Hammond. The NIPSCO Michigan City station and State Line provide fishing opportunities for pedestrian (i.e. shore) anglers. No public entry is allowed at the NIPSCO Bailly Generating Station, although limited access exists just west of the station near Indiana Dunes National Lakeshore boat-in beach. Various industries and private clubs along the shoreline also provide limited access to pedestrian/shore and/or boat anglers [e.g. Mittal Steel (formerly Bethlehem Steel), Burns Harbor; Midwest Steel, Burns Harbor; Amoco Whiting Refinery, Whiting; etc.]. Access, however, is typically limited to employees or members of those businesses or clubs. Access or access restrictions at private industrial properties is directly influenced by the National Threat Advisory issued through the United States Department of Homeland Security. In the past, high national threat levels have resulted in closure to access.

Public access to the tributaries of Lake Michigan is limited to county parks, city parks and state access sites. Main tributaries of the Lake Michigan coastal area include: the Little Calumet River, Grand Calumet River, Turkey Creek, Deep River, Salt Creek, Coffee Creek, Dunes Creek, Trail Creek, Galena River, and several smaller tributaries and man-made ditches.

METHODS

The Lake Michigan creel survey was divided into boat, shore, and stream components. Sport fishing from the boat and shore fisheries was monitored between April 1 and October 31, 2007 at four main ports; Washington Park and Trail Creek Marina in Michigan City; numerous private ramps and slips on Burns Waterway (Portage Marina, Doyne's Marina, Treasure-Chest Marina) in Portage; Pastrick Marina in East Chicago; the Lake County Parks and Recreation Whihala Beach boat launch in Whiting and Hammond Marina in Hammond (Figure 1). The shore fishery was also monitored at the Michigan City Washington park pier, Port of Indiana Public Access Site (Portage), East Chicago Pastrick Marina pier and the Hammond Marina pier. The lake survey was conducted using a non-uniform probability access design. Sampling probabilities, proportional to the amount of fishing expected, were assigned to each site (based upon prior angler survey effort data). The sum of the probabilities assigned to the sampling sites equaled one.

Stream sport fishing surveys were conducted at main public access sites (i.e. county parks, state access sites) and popular fishing areas on Trail Creek, the East Branch of the Little Calumet River and Salt Creek (Figure 1). Each stream was sampled separately, from March 1 through March 31 and from July 1 through December 31, 2007. Trail Creek was sampled from the Trail Creek basin upstream to Johnson Road (Appendix I); the East Branch of the Little Calumet River was sampled from the Ameriplex complex (S.R. 249) upstream to the Indiana National Lakeshore Heron Rookery located on 600 East (Appendix I), and Salt Creek was sampled from the Ameriplex complex upstream to U.S. 30 (Appendix I). The stream survey was conducted using a non-uniform probability roving-access design. Probabilities were assigned to each tributary (based upon prior angler survey effort data) so that the total of the probabilities was equal to one.

Sample size determination followed the guidelines recommended by Shipman and Hudson (1980); survey time covered at least 25% of the available fishing hours. The fishing season was stratified by fishery type (lake or stream), site (port or tributary), survey period (i.e. months), and day type (i.e. weekday, weekend). A two-stage sampling design (see Pollock et al. 1994) was used to assign days (primary sampling unit, PSU)

and the site/shift combination (secondary sampling unit, SSU). The creel survey was conducted on most weekend days and on two to three randomly chosen days during the week. Weekends were sampled more heavily due to heavier fishing effort compared to weekday effort. Holidays were classified as weekend days; however, no holidays were sampled due to administrative restrictions.

Fishing day lengths were standardized for the entire creel season to represent daylight hours (sunrise to sunset). The fishing day was described as 14-hours in length (0600 hours to 2000 hours) from April through September, 12-hours in length (0600 hours to 1800 hours) in March and October, and 9-hours in length (0700 hours to 1600 hours) in November and December. The fishing day was divided into two periods, or shifts: AM and PM. Shifts were equal in duration, did not overlap, and were sampled with equal probability. One or two shifts were worked per workday. Although a seasonal night fishery on Lake Michigan and tributaries exists, personnel safety precluded the justification of including an additional shift in the Lake Michigan creel design.

Two intermittent employees (i.e. clerks) performed the lake survey from April through October; one intermittent employee performed the stream survey in March, and July through December. The shift included time for travel to the site, and scheduling of two non-overlapping periods ranging from 7-hours April through September (0600 to 1300 hours and 1300 to 2000 hours), 6-hours March and October (0600 to 1200 hours and 1200 to 1800 hours) and 4.5-hours November and December (0700 to 1130 hours and 1130 to 1600 hours). All times were adjusted by 1 hour (moved forward or back) during daylight saving time. Dates and SSU's were selected via random selection with replacement. Minor adjustments were made to the schedule in order to comply with the maximum 75-hour bi-weekly state personnel requirements.

Three types of data were collected for each lake site or tributary sampled: angler and/or vehicle counts for effort, angler interviews for harvest rates and total catch, and biological information on harvested fish.

Two types of multiple counts were utilized for the lake creel survey: interval and instantaneous. For the interval count, fishing boats were counted for a twenty-minute period as they returned to the port being surveyed. Three counts were made each day at

the selected port. The count times for the early or late shift were selected at random, without replacement, to insure that counts were made at various hours throughout the day during any given month. Interval boat counts occurred at sample areas where all boats returned to the port through a defined channel. Shore anglers were counted using instantaneous counts, performed immediately following the interval boat counts. Stream effort was measured by utilizing progressive counts. The clerk drove the entire stream section, stopping at predetermined sites to count either angler vehicles or anglers (anglers counted only at the DNR Public Fishing area located in the Trail Creek basin). Two progressive counts were performed per shift. Count times were selected using systematic random sampling as outlined in Pollock et al. (1994).

After the counts were completed, the clerk (s) interviewed anglers to obtain catch and fishing times. Boat angler parties were interviewed at the completion of their fishing trip while shore and stream angler parties were interviewed while they were actively fishing. Both incomplete and completed fishing interviews were obtained from shore and stream anglers. If applicable, incomplete shore and stream fishing trips were updated throughout the shift. Anglers or angler parties were asked what time they started their fishing trip, if they came by car and parked at the vehicle count site (stream anglers only), what they fished for, and the number/type of fish harvested and released. Additional information about angler county-of-residence, species preference, and angler satisfaction was also collected. If a large number of boat, shore or stream anglers were encountered, the clerk (s) sub-sampled anglers for interviewing. Biological information was taken on harvested fish, including species, total length (mm), weight (kg), fin clip, and tag numbers. The collection of weight data from harvested fish began in 2000 and 2001. Both length and weight data were converted to inches and pounds for reporting purposes.

Effort and catch calculations followed Lockwood et al. (1999) and Pollock et al. (1994). Catch (fish harvested and released) and effort estimates were generated for each combination of site (lake port or tributary), day type, fishing mode, month and target species (information on target species obtained from the interviews when anglers were asked what species they were fishing for). From the sample of counts and interviews, catch rate (R) and angling effort (E) were calculated; catch (C) was estimated as their product. All calculations were based upon multiple-day estimates. Multiple-day

estimates treat all interviews within a longer period (i.e. month) as though they were random samples from that longer time period. A single catch-rate was calculated for the month, and then multiplied by effort for that month to produce estimates of catch. Multiple-day estimates were summed over the creel survey time period and angling mode to provide a total estimate of angling effort (angler hours) and catch. Although the multiple-day estimate ignores day-to-day differences in catch rates, inadequate sample sizes precluded the use of daily estimates (Lockwood et al. 1999). For a detailed description of the effort and catch calculations utilized, see Palla (2007).

With Indiana's close proximity to neighboring states' borders and the migratory nature of fish, many boat trips were actually conducted in other states' waters. The estimates provided in this report represent estimates of fish returned to Indiana ports. Since the Lake Michigan creel sampling design differs among years, direct comparison of catch and effort is problematic. Catch-per-unit-of-effort (CPUE) comparisons, however, produce standardized indices of catch to allow yearly comparisons. CPUE is provided as a measure of fishing quality or fishing success for important Lake Michigan sport fish species. Catch, or the total number of fish caught (whether kept or released), provides a more detailed recreational description; thus CPUE was utilized to standardize each fishing season. Estimates of catch and effort are presented without confidence intervals.

RESULTS

From March 1 through December 31, 2007, 2,865 interviews (representing 5,744 anglers) were collected from pedestrian (shore and stream) and boat anglers. Anglers fished an estimated 294,987 hours, an increase (4%) in effort compared to the 2006 fishing season (Table 3). Seventy-one percent of the fishing hours came from boat anglers.

Highest boat fishing effort occurred in April (41,540 hours), followed by June (36,695 hours), August (35,477 hours), July (34,070 hours), and September (29,793). Greatest shore fishing effort occurred in June (12,695 hours), followed by July (6,634 hours) and September (4,799 hours). The months of September (13,836 hours) and October (13,078 hours) accounted for the greatest stream angler effort.

Total catch from the combined fisheries was 245,984 fish representing twenty-six fish species; a decrease (29%) compared to total catch observed during 2006 (Tables 4-6, Appendix II). Yellow perch dominated the 2007 catch, comprising 66% of the total (Tables 4-6). For trout and salmon species, total catch was dominated by coho salmon, comprising 33% of the salmonine total. Chinook salmon catch was second to coho salmon, with 30% of the total; steelhead trout (17%), juvenile trout and salmon (9%), lake trout (7%) and brown trout (4%) followed (Table 7). The majority of the catch came from the boat fishery, accounting for 87% of the total. Juvenile salmonids were mainly caught from the stream fishery. These sub-legal catches occurred mostly during March, October, and November which directly corresponds to state fish hatchery stockings (Table 6).

Trout and salmon (directed effort)

Anglers spent 187,785 hours pursuing trout and salmon, catching 50,753 salmonines, all fisheries combined (Table 8). Of the fish caught, 91%, or 46,114, were equal or greater than the minimum size limit of 14 inches. Catch was greatest during the months of April, July and August for the boat fishery; June for the shore fishery; and November, October and March for the stream fishery.

The combined salmonine CPUE was 24.7 fish/100 angler-hours[1], slightly lower than what was observed in 2006 and 15% lower than the ten-year average of 29.0 (Figure 3). Although the boat CPUE and shore CPUE both increased relative to 2006; the stream CPUE fell approximately 30% between 2006 and 2007, directly influencing the overall salmonine CPUE decline (Figure 4).

The CPUE for Chinook salmon, steelhead trout, brown trout and lake trout all increased compared to the prior fishing season, due primarily to the observed increases in boat CPUE for those salmonine species (Figure 7 through Figure 13). Both the boat brown trout CPUE and lake trout CPUE doubled over what was observed in 2006. For Chinook salmon, the boat CPUE was the highest observed from the prior ten-year period (Figure 8). The steelhead trout CPUE increase was influenced directly by the shore

[1] The CPUE excludes juvenile salmonids. Juvenile salmonid catch data estimates are unavailable for 1997-2005.

fishery; the 2007 CPUE of 8.6 fish/100 angler-hours was the highest rate recorded from the 1998 to 2007 period (Figure 10). The only CPUE that fell compared to the previous fishing season was for coho salmon (Figure 5). The 2007 boat, shore and stream CPUE were the lowest levels observed from the prior ten-year period (Figure 6).

Comparing 2007 salmonine catch rates with their long-term averages, only coho salmon anglers caught fish at below-average rates.

Biological data collected from coho salmon, Chinook salmon, and lake trout showed a slight rise in mean length compared to 2006; mean weight, however, remained unchanged or increased slightly (Appendix III-VIII). Brown trout and steelhead trout mean length and weight both declined compared to 2006 data (Appendix III-VIII).

Average size of harvested coho salmon was 21.2 (± 2.3) in and 3.2 (± 1.3) lbs, similar to the ten-year average (Appendix III-VIII). Size of harvested brown trout and lake trout were also similar to their ten-year average, at 22.0 (± 4.2) in and 5.2 (± 3.3) lbs and 26.9 (± 3.0) in and 7.3 (± 2.5) lbs, respectively. Chinook salmon mean size, however, continues to remain below its long-term average. Harvested Chinook salmon had an average length of 28.1 (± 4.9) in and 8.6 (± 3.9) lbs which was 3% below the ten-year length average and 13% below the ten-year weight average. Steelhead trout mean length and weight was also lower than the ten-year average, 26.0 (± 4.9) in and 6.8 (± 3.3) lbs (length 5% below the ten-year average, weight 11% below the ten-year average).

Yellow perch (directed effort)

Perch anglers fished 87,208 angler hours, catching 161,126 perch. A total of 89,655, or 56% of the total catch, were harvested (Table 10). Both perch effort and catch declined compared to the 2006 survey data, 12% and 40%, respectively.

Boat anglers accounted for the majority of the yellow perch catch, 151,713 fish or 94% of the total. The majority of yellow perch were caught in June, July and August.

Yellow perch ranked first in angler catch, with an overall CPUE of 1.8 fish per angler-hour (Table 10, Figure 14). The 2007 yellow perch CPUE decreased (31%) compared to the 2006 CPUE of 2.6 fish/angler-hour. The 2007 perch CPUE fell below the ten-year mean CPUE of 2.1 fish/angler-hour.

The boat fishery, accounting for the majority of the harvest (and catch), drove the overall success of the yellow perch fishing season (Figure 15).

Harvested yellow perch ranged from 6.9 to 14.1 in (Appendix IX). Mean total length, 10.7 (± 1.5) in, and mean weight, 0.5 (± 0.2) lbs, were both higher than observed in 2006 (Appendix III and IX).

Black bass species

Bass anglers fished 13,598 angler-hours, catching 9,486 black bass, mainly smallmouth (Tables 4-6). The 2007 catch and effort were both higher than observed in 2006 (Table 11). The majority of fishing occurred from boats, accounting for 87% of the effort and 90% of the catch. Most bass caught were released; only 2% of the total catch was harvested. In the boat fishery, the number of legal-sized bass released outnumbered the sub-legal releases (bass less than 14.0 in). In the shore fishery, the number of sub-legal sized bass and legal-sized bass released were similar.

Species preference

All anglers were asked which species of fish they preferred to catch from Lake Michigan and its tributaries. A total of 2,811 responses were recorded from boat, shore, and stream anglers.

Fifty-one percent of boat anglers included at least one salmonine species in their response. On a species by species basis, boat anglers ranked yellow perch as their most preferred fish (42%), followed by Chinook salmon (22%), steelhead trout (12%), coho salmon (12%), and bass (8%). Since 2002, the number of anglers listing coho salmon as their preferred species has steadily declined. This decline corresponds directly to the observed decrease in boat coho salmon CPUE (Figure 6). Similarly, angler preference for Chinook salmon has climbed since 2004, when the boat Chinook salmon CPUE began to increase (Figure 8).

Fifty-four percent of shore anglers also included at least one salmonine species in their response. By species, 31% of shore anglers ranked yellow perch as their most preferred fish. Steelhead trout (31%), Chinook salmon (11%), bass (5%), coho salmon (5%), and brown trout (2%) were also among the preferred species. Similar to boat

anglers, the number of shore anglers listing Chinook salmon as their most preferred species has increased since 2004.

Stream anglers ranked steelhead trout as the most preferred stream species, accounting for 70% of the responses. Chinook salmon (11%), any trout or salmon (6%), coho salmon (5%), and brown trout (2%) followed.

Angler residency

Anglers from 62 Indiana counties were interviewed during the survey (Appendix X). The majority of anglers were from Lake County, accounting for 26% of all anglers. LaPorte County, Porter County, and out-of-state residents followed, with 23%, 17%, and 16% of the anglers, respectively. Other counties with frequent use included St. Joseph County, Elkhart County, Allen County, and Marion County.

Anglers from thirteen different states were represented in the survey, with the majority of these anglers coming from Illinois (85%); primarily Cook and Will Counties.

Importance and satisfaction ratings

During the interview process, fishing parties were asked to rate the importance they placed on having the species they were targeting in Lake Michigan (or tributary) and to rate their overall satisfaction with the quality of that specific fishery within the past 2-year period. If the fishing party was targeting any trout or salmon, all five trout and salmon species were asked to be rated.[2] Parties were instructed to rate the importance and satisfaction questions on a 5-point scale of "Not Important" or "Not Satisfied" (a "1" rating) to "Very Important" or "Very Satisfied" (a "5" rating). If the party was unable to rate these questions because of lack of fishing experience, the rating was recorded as a 6 (don't know).

Overall, anglers felt it was "Very Important" to "Important" to have their targeted species in Lake Michigan and its tributaries (Appendix XI). Less than 2% of anglers responded with a rating of 1 or 2 (i.e. "Not Important" or "Of Little Importance").

[2] Stream anglers were not asked to rate lake trout since lake trout are confined mainly to Lake Michigan proper.

The majority of anglers felt "Somewhat Satisfied" to "Extremely Satisfied" with the trout and salmon fishery; greater than 74% of all anglers rated satisfaction between 3 and 5. However, 30% of boat and shore anglers and 37% of stream anglers were "Less Than Satisfied" with the brown trout fishery. Fifty percent of the shore anglers and 20% of the boat anglers were "Less Than Satisfied" with the lake trout fishery.

For yellow perch, only 7% of the perch parties gave a low satisfaction rating.

DISCUSSION

Comparing salmonine catch rates with their 10-year averages, the 2007 fishing was good to excellent for Chinook salmon, steelhead trout, brown trout, and lake trout. The catch rates for these salmonine species all increased compared to 2006; primarily due to the noted increases in the boat CPUE. The Chinook salmon catch rate was the highest observed from the prior ten-year period. Lake-wide, Chinook salmon recreational catch rates are also at all-time high levels (16.0 fish/100 hours). These extremely high catch rates may be indicative of high Chinook salmon densities, low prey abundance, or a combination of both (Claramunt et al. 2008).

Although the boat and shore CPUE both increased relative to 2006; the stream CPUE fell approximately 30% between 2006 and 2007. The largest catch rate decline noted specifically for Chinook and coho salmon. The 2007 stream coho salmon catch rate was the lowest recorded for the 1998 through 2007 period. The boat and shore coho salmon catch rates were also the lowest levels observed from the same ten-year period. Overall, fishing was poor for coho salmon within the southern basin of Lake Michigan during 2007.

The decline in the number of coho salmon stocked lake-wide may explain the below-average coho catch rates observed within Indiana waters. Between 2005 and 2006, 25% less coho were stocked by the State of Wisconsin. Whether the poor coho catch was a function of decreased fish availability or other environmental factors (e.g. salmonine forage levels, continued availability of other salmonine species), however, remains unknown.

The average weight of Chinook salmon and steelhead harvested during this survey was considerably lower when compared to the average weight from 1997 through

2006. This is likely due to the decline in the Lake Michigan forage base. Estimates of total lake-wide prey fish biomass from the Great Lakes Science Center (GLSC) indicate that 2007 levels were the lowest observed since the survey began in 1973 (Madenjian et al. 2008). Alewife biomass in 2007, however, was approximately 18% higher than in 2006. Only in 1984, 1985, 1994, and 2006 were adult alewife biomass densities less than what was observed in 2007. Additionally, the GLSC has documented a 14% decline in the condition (weight at a given length) of alewife in Lake Michigan since the mid-90's. Diets of Chinook salmon are heavily dominated by alewife, whereas trout diets are more diverse (Jude et al. 1987). Thus, trout may have better growth than salmon since they utilize a broader range of prey including yellow perch, rainbow smelt and bloater chubs. Changes in the Lake Michigan ecosystem (i.e. introduction of exotic species; stocking levels; forage levels, water levels, etc.) have made the salmonine fishery less predictable. Recent downward trends in forage abundance, ration, and growth will likely continue to influence future catch rates and harvest levels (Claramunt et al. 2008).

For yellow perch, the 2007 effort, catch, and CPUE all declined. This was due to the combination of poor weather conditions and fluctuating water temperatures. Typically, the months of June through August account for the largest perch effort and catch within Indiana waters. However, yellow perch were widely distributed in the southern basin during these months, making fishing extremely challenging. Ball State University total gillnet catch data confirms low numbers of perch within Indiana waters, as their June through August catch decreased by 50% from the near record catch of 100 fish/net-night observed in 2006 (Doll and Lauer 2007). Several yellow perch charter fishing trips were cancelled in July and August, due to the poor weather and its impact on yellow perch distribution (Chuck Weis, personal communication).

The yellow perch stock continues to rebuild, with the perch population mainly comprised of the 1998, 2002, 2003 and 2005 year classes. The 1998 year class is still present, in low numbers, accounting for only 4-8% of the current population. Fishing for yellow perch should remain good to excellent, as Ball State University gill net catch per unit effort (CPUE) of stock sized yellow perch (>7 in) remains high (Doll and Lauer 2007). Additionally, the reproductive potential of mature female yellow perch also

remains well above levels observed in the early 1990s (i.e. female potential for egg production is high).

In Lake Michigan, tremendous changes have occurred to the fish community since the introduction of Pacific salmon to control the overabundance of alewives. While the future angling success within Indiana's waters of Lake Michigan may be difficult to predict, one thing is certain, anglers are provided with unique and diverse fishing opportunities. The variety of quality game fish alone, make Indiana waters of Lake Michigan a world class fishery.

RECOMMENDATIONS

- The Lake Michigan Fisheries Research Office should continue to assess sport fish harvest, fishing pressure and angler opinions through the Lake Michigan creel survey. Information on sport fishery harvest and catch per unit effort is essential to make management decisions and develop a better understanding of population dynamics.

- The Lake Michigan Fisheries Research Office should continue to provide creel survey data to the Lake Michigan Technical Committee for use in the recreational database, the lake-wide harvest extraction database, as well as for the Salmonid Working Group in the development of a management strategy for predator/prey communities in the lake.

- The Lake Michigan Fisheries Research Office should evaluate the fall lake trout fishery by incorporating November into the creel survey schedule. This sampling would provide information on overall catch and harvest, and provide data to guide fishery management efforts for the rehabilitation of lake trout in Lake Michigan.

- The Lake Michigan Fisheries Research Office should continue to look for ways to reduce program costs by utilizing naturalist aides to conduct creel during the summer and fall months.

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Table 1. Number of trout and salmon stocked in Lake Michigan by Indiana Department of Natural Resources, 1995 through 2007.

	LAKE MICHIGAN				ST. JOSEPH RIVER			
	Brown Trout	Chinook Salmon	Coho Salmon	Steelhead	Chinook Salmon	Coho Salmon	Steelhead	Total
1995	0	364,182	165,809	301,052	190,819	0	188,842	1,210,704
1996	0	362,162	266,549	312,776	209,407	75,980	254,135	1,481,009
1997	0	279,297	80,817	340,010	143,262	0	287,174	1,130,560
1998	0	386,525	148,320	183,715	206,987	0	299,869	1,225,416
1999	0	264,608	146,882	319,082	150,811	0	252,491	1,133,874
2000	0	267,865	157,208	174,136	149,911	0	220,439	969,559
2001	0	297,195	157,048	297,971	153,520	0	293,475	1,199,209
2002	35,000	253,000	224,797	298,884	0	0	306,297	1,117,978
2003	40,400	232,395	233,248	309,134	0	0	282,857	1,098,034
2004	46,238	237,052	236,026	334,968	0	0	278,109	1,132,393
2005	36,371	251,281	237,009	645,576	0	0	287,471	1,457,708
2006[1]	42,900	225,000	79,018	257,206	0	0	234,211	838,335
2007[2]	41,110	217,389	231,342	349,497	0	0	279,255	1,118,593

[1]Due to the shut-down and rehabilitation of Mixsawbah State Fish Hatchery in 2006, the coho salmon plantings were reduced by 60%; the spring release skamania steelhead were stocked in the fall of 2005 as fingerlings; Michigan steelhead (winter-run) were stocked in 2007 as yearlings instead of December 2006 as fingerlings; and the St. Joseph River fall steelhead plantings were reduced by approximately 40,000 fish to offset changes to the Trail Creek and Little Calumet River steelhead stockings

[2]Due to the shut-down and rehabilitation of Mixsawbah State Fish Hatchery in 2006, the spring release skamania steelhead were stocked in the fall of 2006 as fingerlings.

Table 2. Millions of trout and salmon, fingerling and yearling stages combined, stocked in Lake Michigan between 1995 and 2007.

	Atlantic Salmon	Brook Trout	Brown Trout	Chinook Salmon	Coho Salmon	Lake Trout	Rainbow Trout	Splake	TOTAL
1995	0.000	0.328	1.876	6.549	2.401	2.265	1.878	0.151	15.448
1996	0.000	0.180	1.787	6.193	3.112	2.141	1.849	0.201	15.463
1997	0.000	0.115	1.804	5.745	2.620	2.235	1.864	0.155	14.538
1998	0.000	0.408	1.742	5.721	2.059	2.302	1.618	0.097	13.948
1999	0.000	0.191	1.649	4.324	2.765	2.348	1.680	0.077	13.034
2000	0.000	0.045	1.666	4.049	2.499	2.260	1.244	0.079	11.842
2001	0.000	0.102	1.749	4.518	2.765	2.382	1.849	0.131	13.495
2002	0.000	0.050	1.754	4.015	2.690	2.224	1.861	0.126	12.720
2003	0.000	0.024	1.649	4.422	3.124	2.609	2.078	0.104	14.010
2004	0.000	0.001	1.601	4.303	1.687	2.354	1.583	0.122	11.651
2005	0.000	0.000	1.523	4.306	2.561	2.887	2.170	0.099	13.546
2006	0.000	0.001	1.611	3.253	2.430	2.770	1.788	0.166	12.019
2007	0.000	0.000	1.487	3.173	2.269	3.624	2.010	0.125	12.688
Avg.	0.000	0.111	1.684	4.659	2.537	2.492	1.805	0.126	13.415

Table 3. Estimated angler hours and catch from the Indiana Department of Natural Resources Lake Michigan creel survey during 2007, based on total effort.

Fishery	Total Effort	%	Catch	%
Boat	208,573	(71%)	213,019	(87%)
Shore	35,406	(12%)	21,872	(9%)
Stream	51,008	(17%)	11,093	(4%)
TOTAL	294,987	(100%)	245,984	(100%)

Table 4. Boat fishery monthly estimated catch and effort from the Indiana Department of Natural Resources Lake Michigan creel survey during 2007, based on total effort.

Species	April	May	June	July	Aug.	Sept.	Oct.	Total
Steelhead	390	828	595	1,411	400	206	41	3,871
Coho	5,412	3,888	2,972	2,263	1,808	127	34	16,504
Chinook	114	459	448	4,643	5,555	2,830	463	14,512
Lake trout	1,921	509	189	276	682	17	71	3,665
Brown trout	1,270	244	34	39	103	93	0	1,783
TOTAL	9,107	5,928	4,238	8,632	8,548	3,273	609	40,335
Yellow perch	12,271	2,465	56,500	25,207	32,472	10,285	12,883	152,083
Black Bass sp.	972	1,147	3,742	1,007	130	1,041	552	8,591
Other	254	1,042	8,507	1,240	219	531	217	12,010
Angler hours	41,540	18,435	36,695	34,070	35,477	29,793	12,563	208,573

Table 5. Shore fishery monthly estimated catch and effort from the Indiana Department of Natural Resources Lake Michigan creel survey during 2007, based on total effort.

Species	April	May	June	July	Aug.	Sept.	Oct.	Total
Steelhead	16	16	1,114	252	10	23	0	1,431
Coho	6	0	0	0	0	35	0	41
Chinook	0	0	4	0	0	57	11	72
Lake trout	0	0	0	0	0	0	0	0
Brown trout	46	0	16	9	0	4	0	75
smolts*	15	13	23	0	0	0	0	51
TOTAL	83	29	1,157	261	10	119	11	1,670
Yellow perch	15	31	6,334	1,218	1,676	180	25	9,479
Black Bass sp.	247	114	184	83	59	85	48	820
Other	619	1,446	4,483	1,635	1,102	355	263	9,903
Angler hours	3,757	2,278	12,695	6,634	4,000	4,799	1,243	35,406

* juvenile salmonids.

Table 6. Stream fishery monthly estimated catch and effort from the Indiana Department of Natural Resources Lake Michigan creel survey during 2007, based on total effort.

Species	March	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Steelhead	399	1,141	266	670	344	301	115	3,236
Coho	20	0	0	352	207	0	0	579
Chinook	0	0	0	104	484	65	0	653
Brown trout	100	0	0	24	24	0	30	178
smolts*	1,129	429	30	254	733	1,787	9	4,371
TOTAL	1,648	1,570	296	1,404	1,792	2,153	154	9,017
Yellow perch	0	12	13	136	0	0	0	161
Black Bass spp.	5	0	16	48	6	0	0	75
Other	290	155	257	1,003	109	0	26	1,840
Angler hours	5,807	7,778	4,111	13,836	13,078	4,589	1,809	51,008

*juvenile salmonids.

Table 7. Estimated salmonine and yellow perch catch from the Indiana Department of Natural Resources Lake Michigan creel survey during 2007, based on total effort.

Yellow perch	161,723	
Total Salmonids	51,022	
Coho	17,124	(33%)
Chinook	15,237	(30%)
Steelhead	8,538	(17%)
Smolts[1]	4,422	(9%)
Lake Trout	3,665	(7%)
Brown Trout	2,036	(4%)
Total	*51,022*	

[1]juvenile salmonids

Table 8. Estimated trout and salmon catch and effort from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, based on directed effort.

Year	Chinook Salmon	Coho Salmon	Steelhead Trout	Lake Trout	Brown Trout	Smolts[1]	Total	Directed Effort (hrs.)
1998	5,810	78,690	25,158	23,340	1,240	---	134,238	379,743
1999	13,938	48,740	21,760	3,036	1,049	---	88,523	354,481
2000	14,092	83,505	18,604	4,272	3,319	---	123,792	353,750
2001	9,644	75,207	11,857	4,708	2,602	---	104,018	334,359
2002	17,309	107,432	15,299	1,709	2,654	---	144,403	362,228
2003	8,396	56,144	11,133	624	1,122	---	77,419	290,486
2004	11,407	23,668	5,566	308	1,191	---	42,140	197,291
2005	19,937	37,222	9,748	3,441	1,914	---	72,262	274,161
2006[2]	12,092	21,768	6,044	1,513	787	5,666	47,870	168,650
2007	15,219	17,083	8,452	3,635	1,980	4,384	50,753	187,785

[1] Smolt (juvenile salmonid) catch data estimates unavailable for 1997-2005.

[2] Indiana Lake Michigan creel survey re-designed; modifications implemented in 2006.

Table 9. Estimated trout and salmon harvest and effort from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, based on directed effort.

Year	Chinook	Coho	Steelhead	Lake Trout	Brown Trout	Total	Directed Effort (hrs.)
1998	4,952	69,258	22,290	22,795	963	120,258	379,743
1999	8,691	45,465	16,496	2,888	754	74,294	354,481
2000	11,006	76,227	14,968	3,230	2,787	108,218	353,750
2001	7,864	72,171	9,605	3,910	2,244	95,794	334,359
2002	14,483	100,351	13,178	1,221	2,378	131,611	362,228
2003	7,092	53,935	9,223	374	942	71,566	290,486
2004	10,966	23,079	4,199	281	974	39,499	197,291
2005	19,098	35,858	8,421	3,208	1,649	68,234	274,161
2006[1]	10,923	19,663	5,057	1,429	654	37,726	168,650
2007	14,405	16,437	7,177	2,818	1,770	42,607	187,785

[1] Indiana Lake Michigan creel survey re-designed; modifications implemented in 2006.

Table 10. Estimated yellow perch harvest, catch, and effort from the Indiana Department of Natural Resources Lake Michigan creel survey, 1988 though 2007, based on directed effort.

Year	Effort (hrs.)	Harvest	Total harvest/hr.	Catch[1]	Total Catch/hr.
1988	75,030	240,251	3.20	---	---
1989	65,610	158,931	2.42	---	---
1990	74,492	132,249	1.78	---	---
1991	133,912	273,888	2.05	---	---
1992	102,600	171,561	1.67	---	---
1993	88,674	146,560	1.65	---	---
1994	44,124	66,785	1.51	71,920	1.63
1995	55,900	69,770	1.25	80,312	1.44
1996	76,360	137,791	1.80	159,168	2.08
1997	33,938	32,390	0.95	34,532	1.02
1998	40,125	37,532	0.94	50,494	1.26
1999	90,622	132,217	1.46	227,304	2.51
2000	96,537	129,988	1.35	215,382	2.23
2001	122,770	140,089	1.14	216,341	1.76
2002	97,161	124,656	1.28	198,275	2.04
2003	119,200	207,401	1.74	309,561	2.60
2004	97,971	144,442	1.47	201,906	2.06
2005	129,630	178,945	1.38	332,320	2.56
2006[2]	99,691	152,202	1.53	267,907	2.69
2007	87,208	89,655	1.03	161,126	1.85

[1]Catch data estimates unavailable for 1987-1993.
[2] Indiana Lake Michigan creel survey re-designed; modifications implemented in 2006.

Table 11. Estimated number of black bass harvested and released by boat and shore anglers from the Indiana Department of Natural Resources Lake Michigan creel survey, 2002 through 2007.

			Released		Released			
	Harvest		<14	≥14	<14	≥14	Directed Effort	
Year	Boat	Pier	Boat	Boat	Pier	Pier	Boat	Pier
2002	111	132	9,022	7,606	438	207	18,257	2,101
2003	367	78	1,253	4,220	902	135	13,794	1,850
2004	194	89	1,789	2,081	901	151	6,020	1,247
2005	106	108	3,410	4,288	1,033	254	8,470	2,134
2006[1]	94	80	1,532	4,179	527	377	11,605	917
2007	93	149	1,509	6,989	326	345	11,889	1,628

[1] Indiana Lake Michigan creel survey re-designed; modifications implemented in 2006.

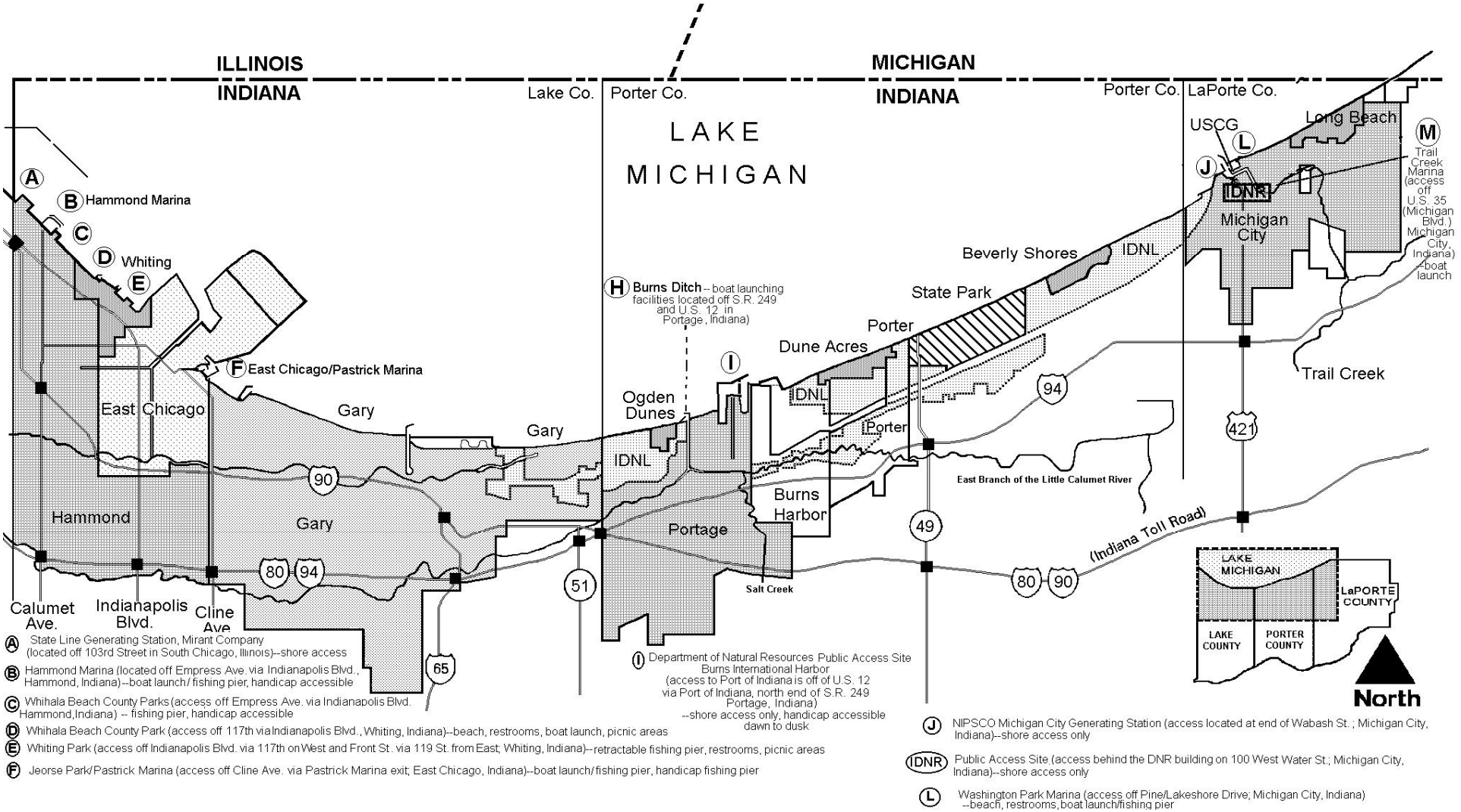


Figure 1. Indiana shoreline of Lake Michigan.

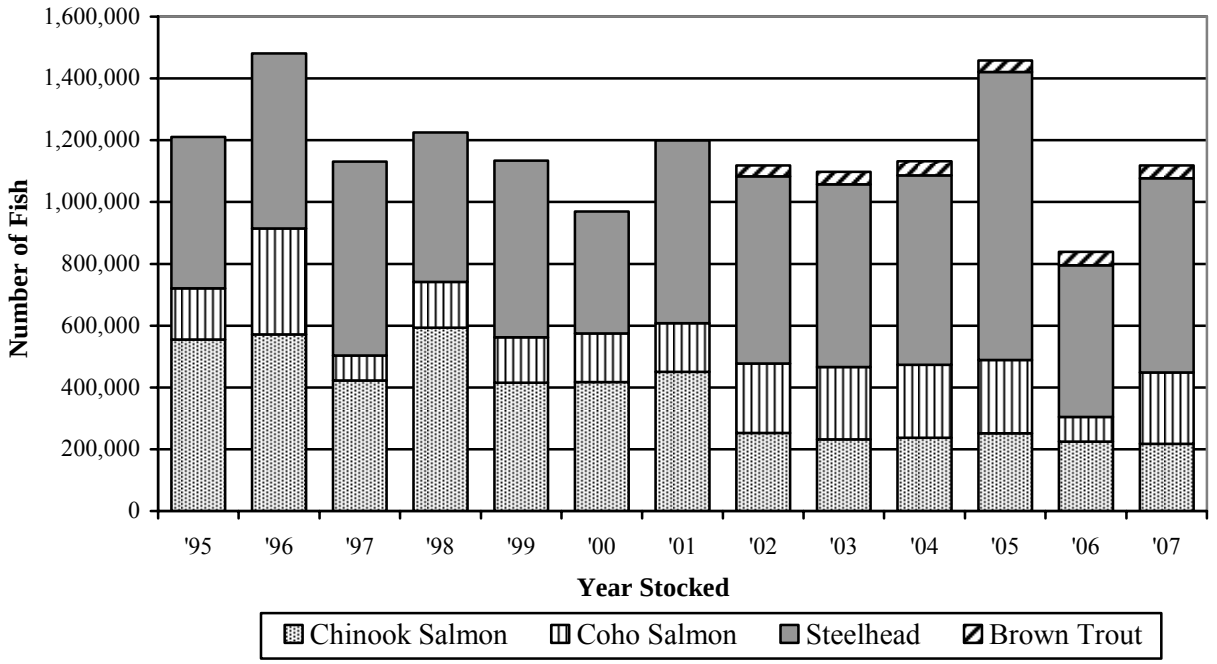


Figure 2. Number of trout and salmon stocked in Lake Michigan by the Indiana Department of Natural Resources, 1995 through 2007.

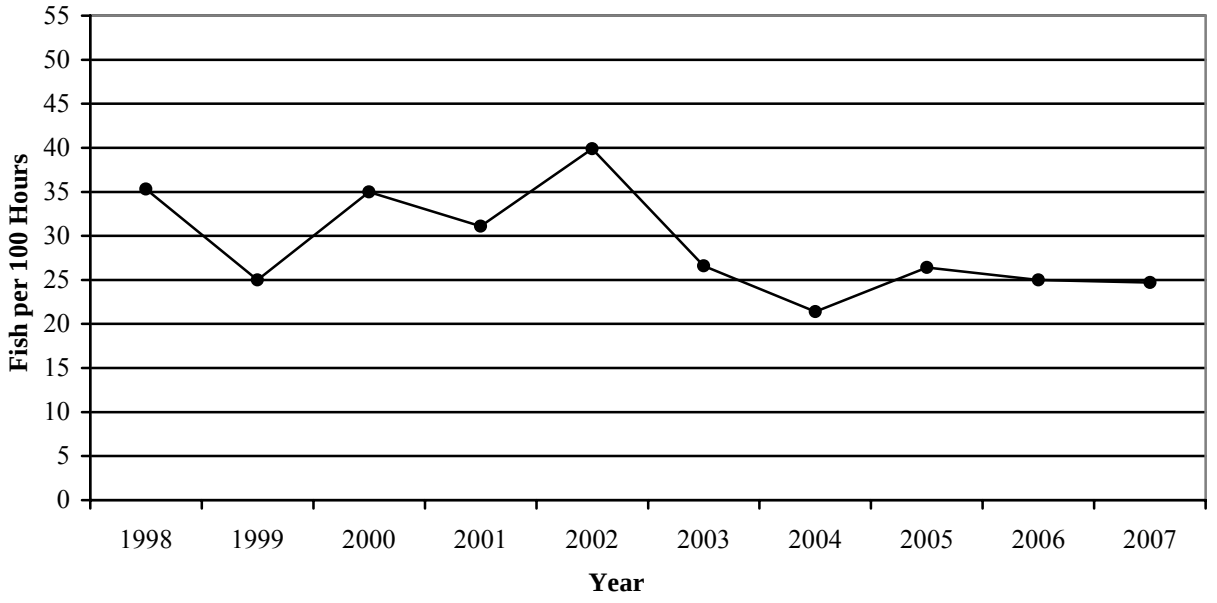


Figure 3. Trout and salmon CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, based on directed effort.

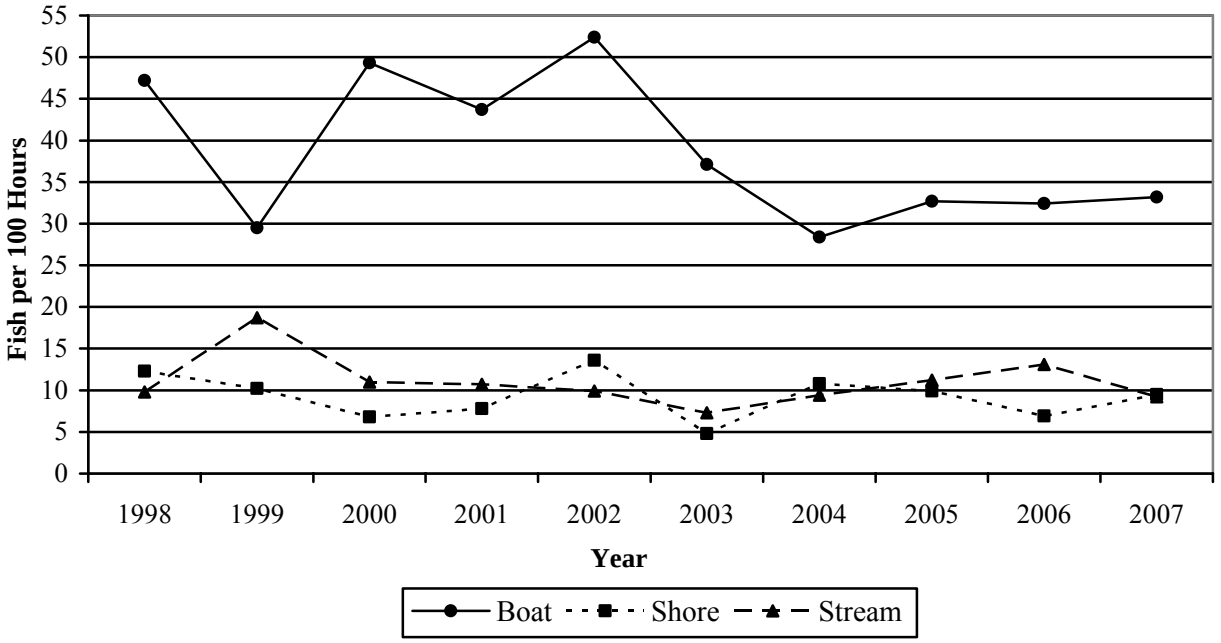


Figure 4. Trout and salmon CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, by angler type (directed effort).

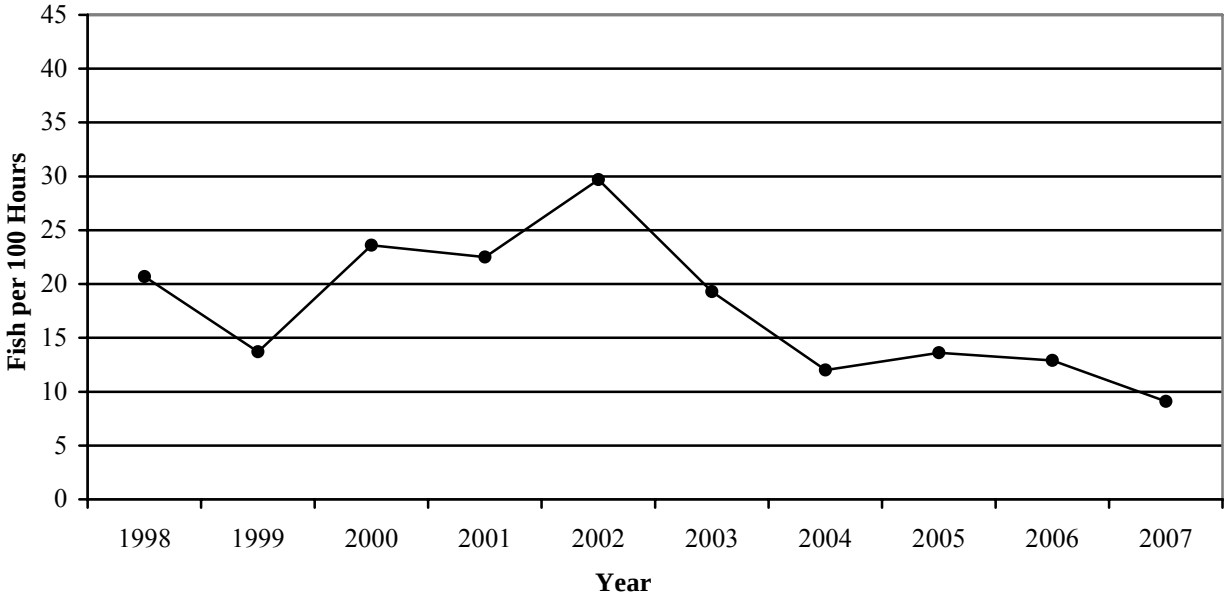


Figure 5. Coho salmon CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, based on directed effort.

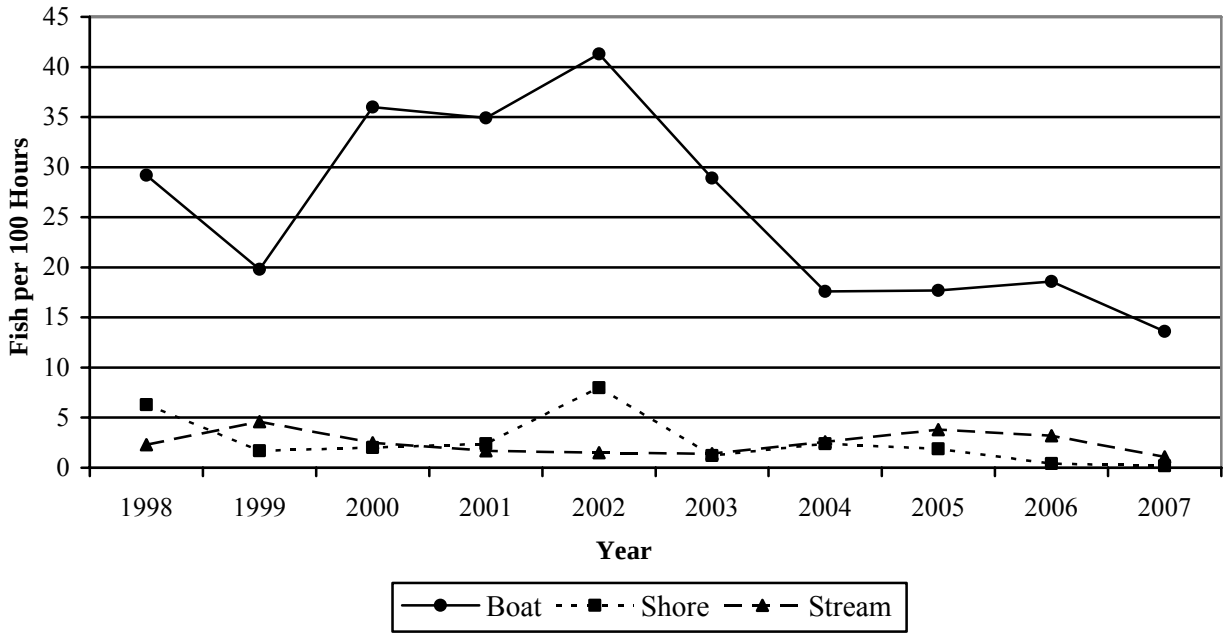


Figure 6. Coho salmon CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, by angler type (directed effort).

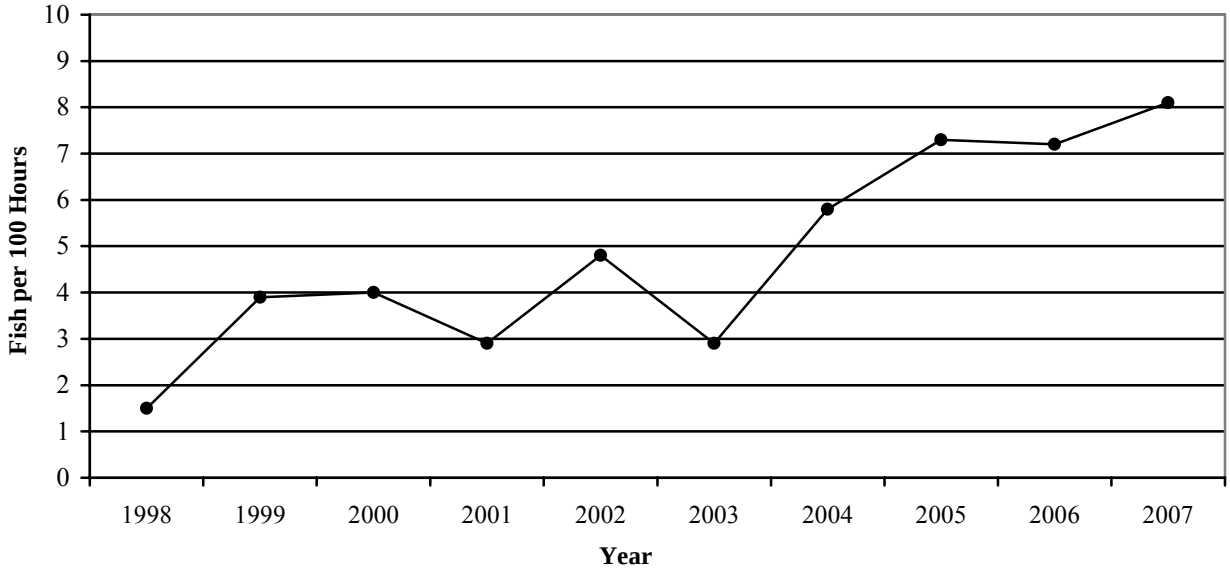


Figure 7. Chinook salmon CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, based on directed effort.

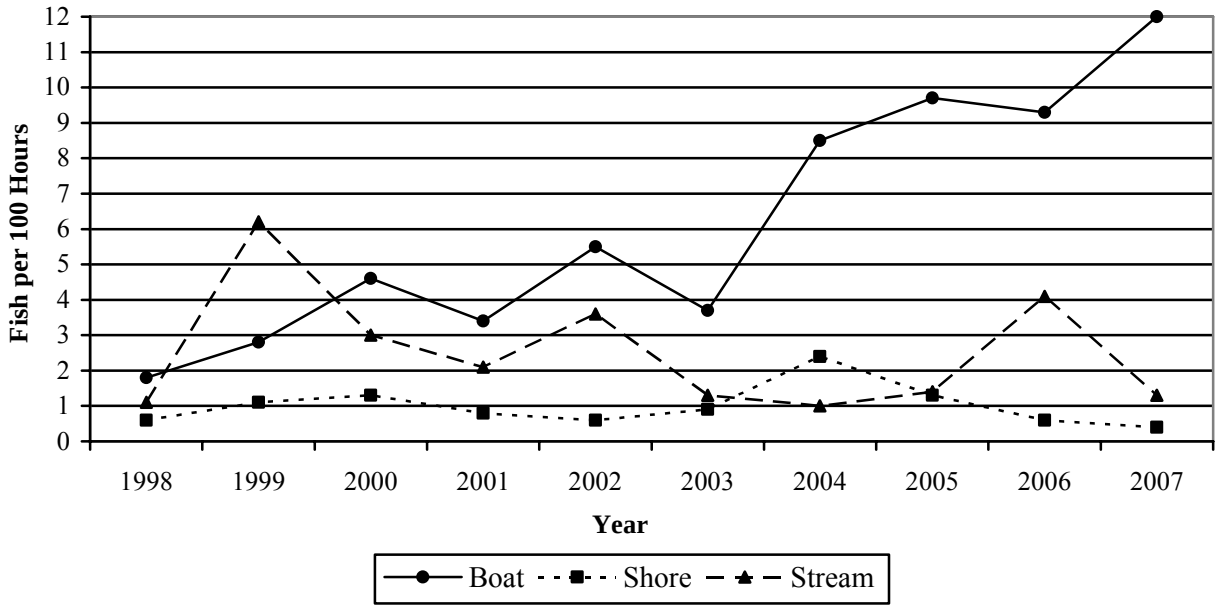


Figure 8. Chinook salmon CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, by angler type (directed effort).

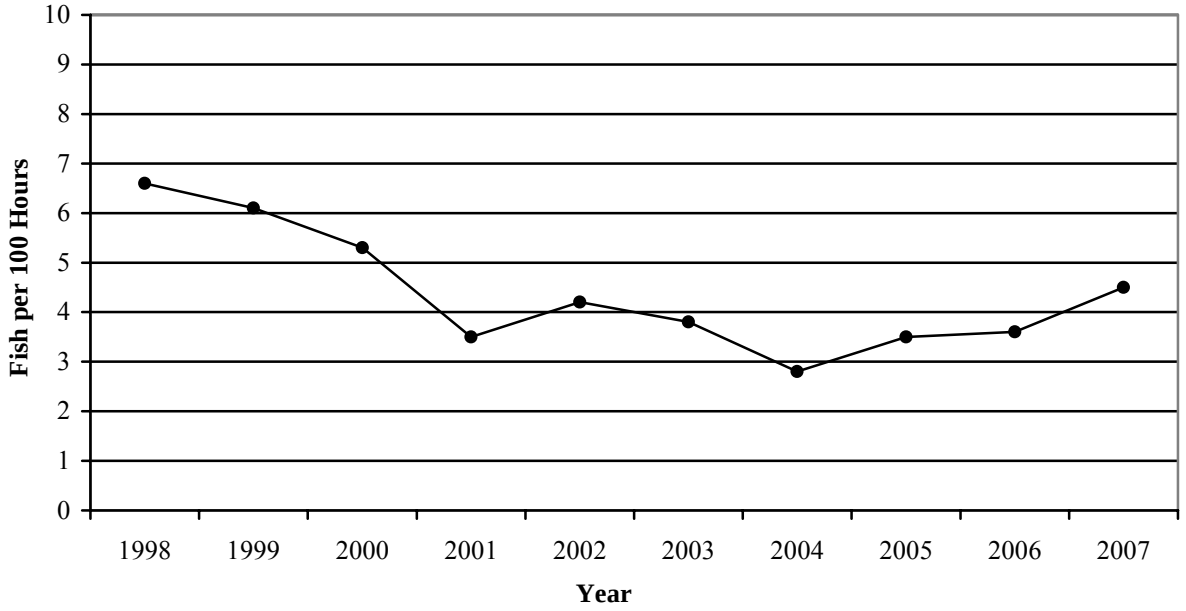


Figure 9. Steelhead trout CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, based on directed effort.

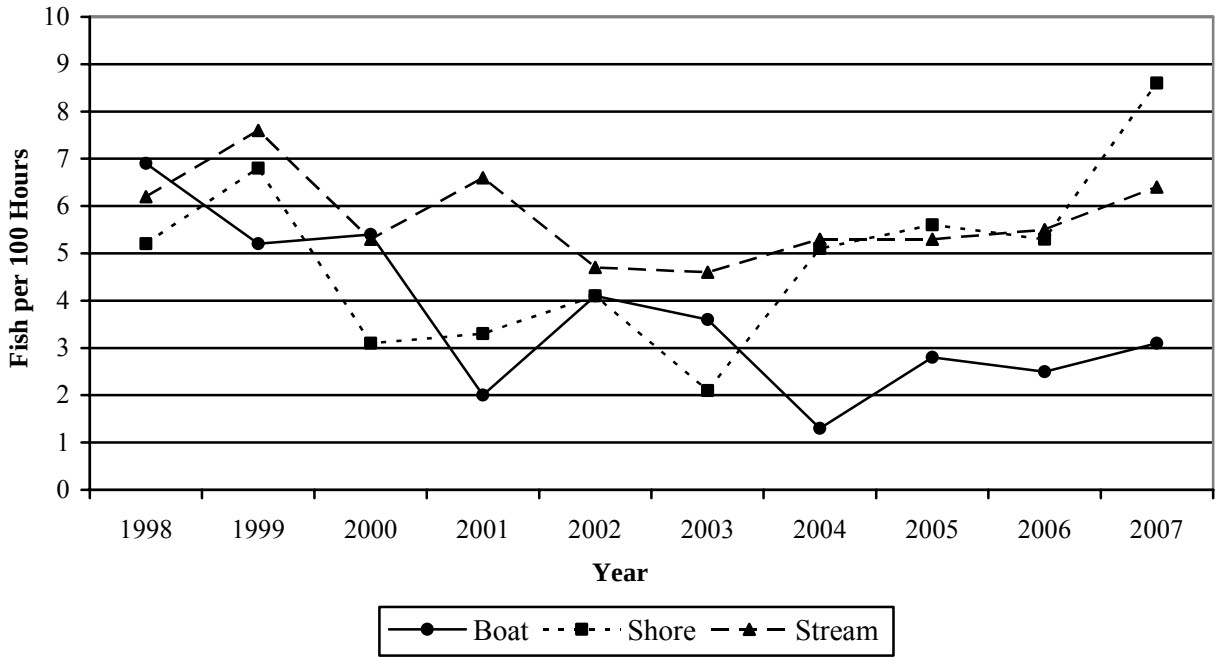


Figure 10. Steelhead trout CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, by angler type (directed effort).

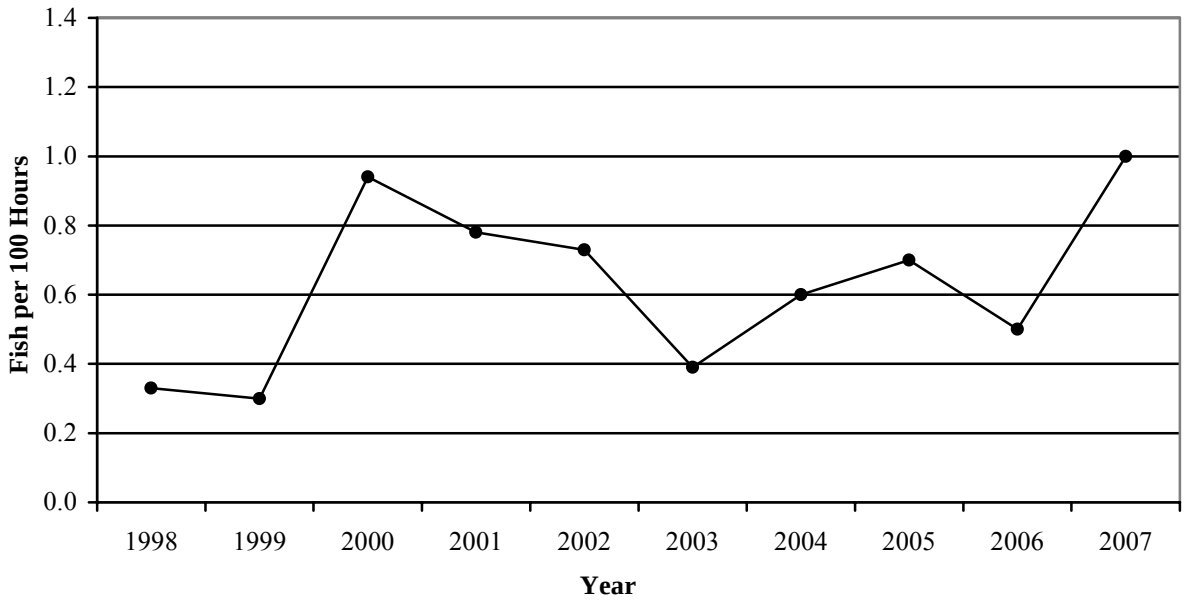


Figure 11. Brown trout CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, based on directed effort.

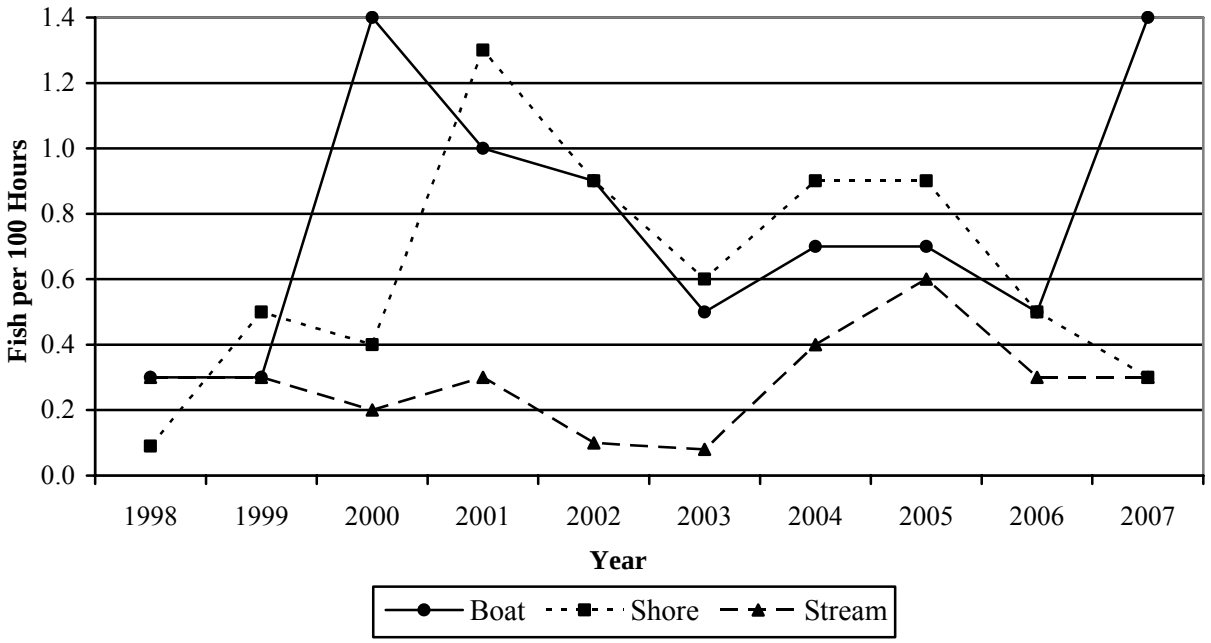


Figure 12. Brown trout CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, by angler type (directed effort).

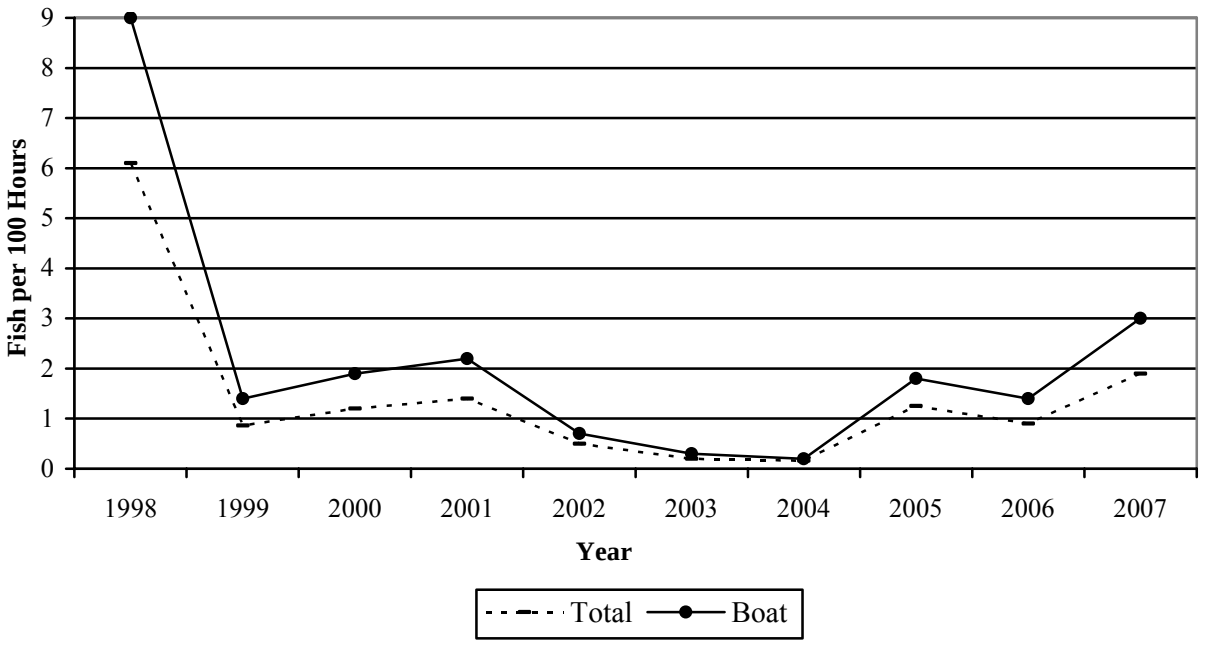


Figure 13. Lake trout CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, based on directed effort.

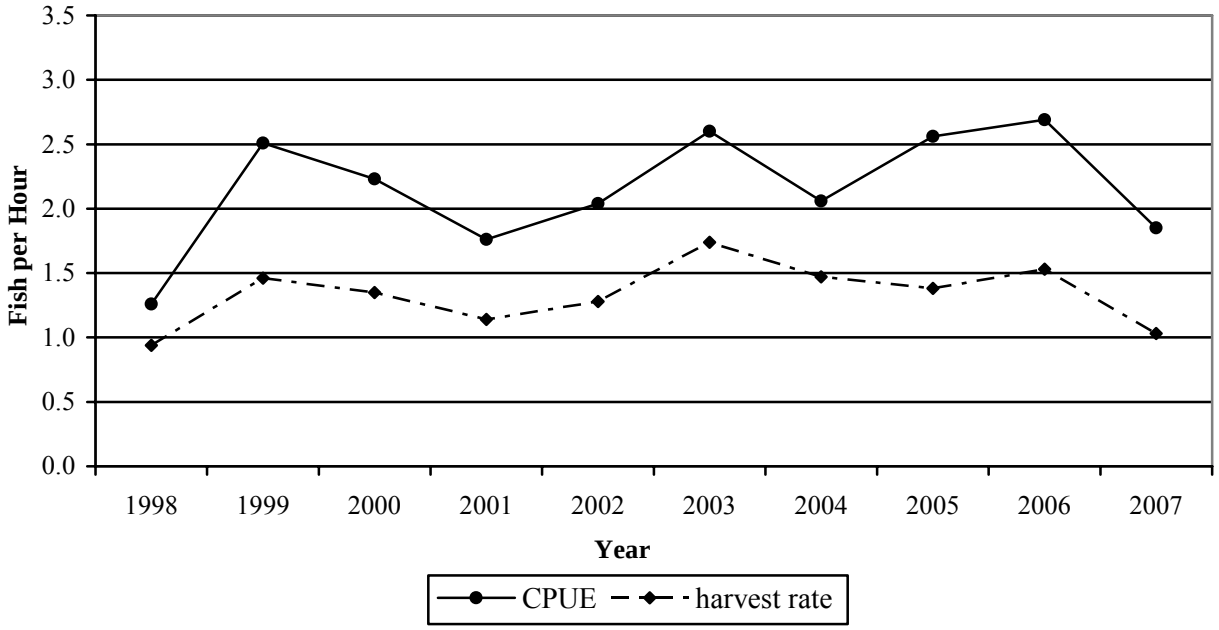


Figure 14. Yellow perch CPUE and harvest-per-unit-effort (harvest rate) from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, based on directed effort.

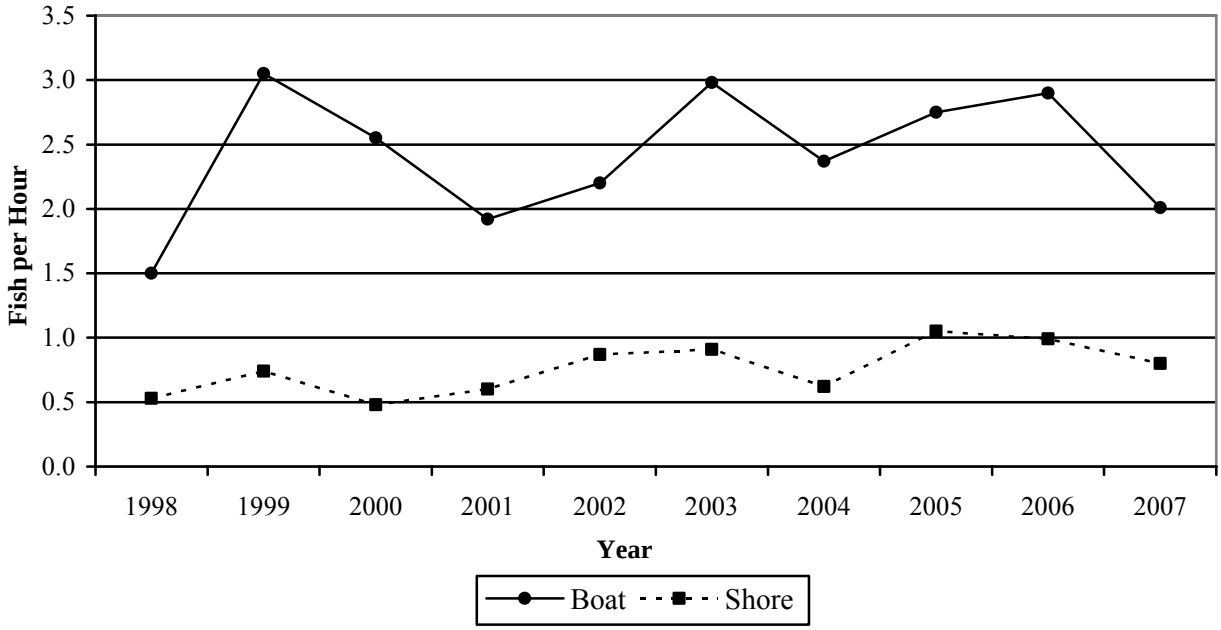
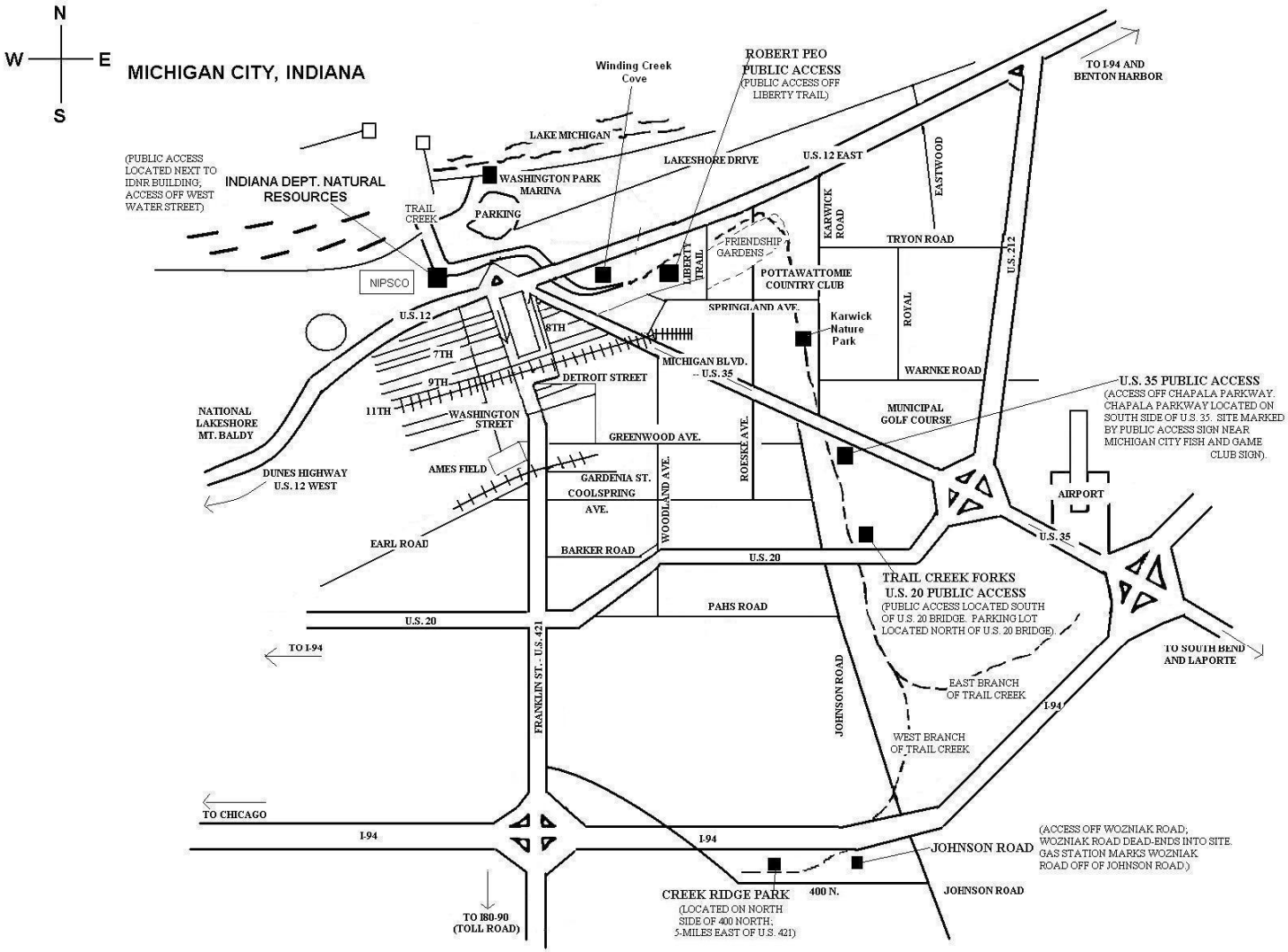
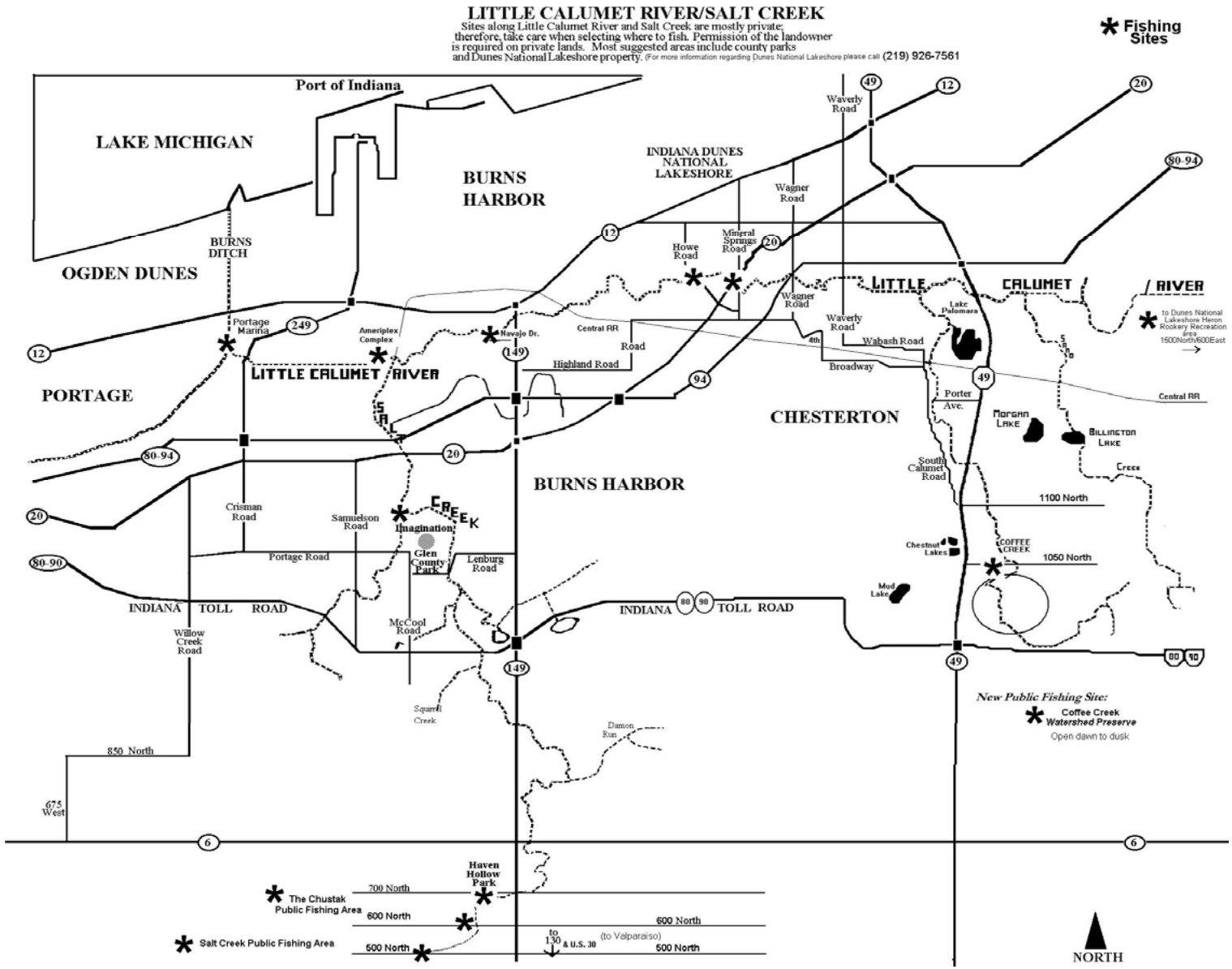


Figure 15. Yellow perch CPUE from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007, by angler type (directed effort).



Appendix I (a). Trail Creek public access map.



Appendix I (b). East Branch of the Little Calumet/Salt Creek public access map.

Appendix II. Estimated total catch for species other than salmonines, yellow perch, or black bass species from the Indiana Department of Natural Resources Lake Michigan creel survey during 2007.

	Catch					
	Boat Fishery		Shore Fishery		Stream Fishery	
	Number Harvested	Total Catch	Number Harvested	Total Catch	Number Harvested	Total Catch
Bowfin	---	---	0	12	---	---
Bullhead	---	---	0	15	0	25
Catfish	230	667	250	372	45	65
Carp	0	16	11	44	0	6
Chubs	---	---	---	---	58	335
Crappie	0	17	111	150	12	12
Freshwater Drum	18	232	118	369	---	---
Herring Family (Alewife/Gizzard Shad)	18	115	0	55	---	---
Northern Pike	---	---	---	---	---	---
Rainbow Smelt	---	---	---	---	0	20
Rock Bass	191	927	297	1,195	0	57
Round Goby	8,532	10,016	4,147	6,335	363	920
Suckers	---	---	---	---	49	265
Sunfish (Bluegill/Green Sunfish/Redear/Pumpkinseed)	0	20	321	1,356	55	120
Walleye	---	---	---	---	15	15
TOTAL	8,989	12,010	5,255	9,903	597	1,840

Appendix III. Average length and weight of salmonine species and yellow perch observed from the Indiana Department of Natural Resources Lake Michigan creel survey during 1998 through 2007. Data from boat, shore, and stream fisheries combined. std. = standard deviation.

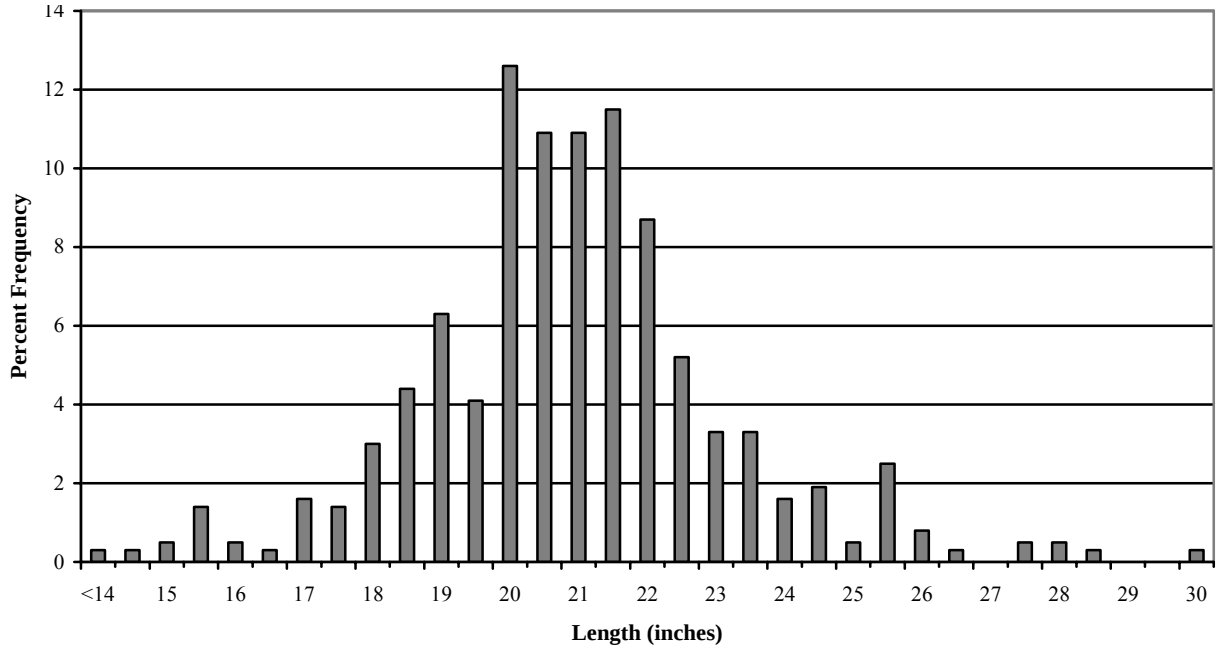
Year	Average length (in)	std.	Average weight (lb)	std.
Brown Trout				
1998[1]	21.9 (n=49)	4.48	---	---
1999[1]	20.3 (n=60)	3.72	---	---
2000	21.8 (n=59)	3.90	5.36 (n=58)	3.97
2001	22.3 (n=94)	5.05	5.95 (n=88)	4.10
2002	21.1 (n=102)	4.33	4.83 (n=96)	3.38
2003	20.7 (n=51)	3.78	4.58 (n=51)	3.12
2004	22.9 (n=55)	4.63	6.53 (n=53)	4.07
2005	22.8 (n=68)	4.57	6.05 (n=68)	4.24
2006	23.6 (n=26)	4.65	6.70 (n=26)	4.13
2007	22.0 (n=53)	4.21	5.24 (n=53)	3.30
Coho Salmon				
1998[1]	18.7 (n=1,466)	1.76	---	---
1999[1]	23.4 (n=1,434)	2.83	---	---
2000	21.0 (n=598)	3.12	3.46 (n=555)	2.23
2001	21.0 (n=513)	2.66	3.59 (n=509)	1.66
2002	19.4 (n=1,008)	2.54	2.66 (n=978)	1.41
2003	20.1 (n=945)	2.43	3.02 (n=940)	1.37
2004	20.7 (n=378)	3.11	3.54 (n=375)	2.01
2005	20.1 (n=516)	2.35	2.69 (n=516)	1.20
2006	20.7 (n=436)	2.15	3.10 (n=436)	1.34
2007	21.2 (n=365)	2.30	3.19 (n=364)	1.31
Chinook Salmon				
1998[1]	25.2 (n=213)	5.93	---	---
1999[1]	30.0 (n=281)	5.43	---	---
2000	28.3 (n=288)	6.55	9.74 (n=267)	5.84
2001	30.0 (n=410)	4.45	11.4 (n=405)	4.73
2002	30.7 (n=585)	4.83	11.8 (n=584)	4.82
2003	28.1 (n=218)	4.62	8.87 (n=218)	4.54
2004	29.2 (n=389)	4.27	9.98 (n=389)	3.61
2005	27.7 (n=375)	4.76	7.92 (n=374)	3.61
2006	27.8 (n=285)	4.24	8.39 (n=285)	3.83
2007	28.1 (n=164)	4.86	8.57 (n=164)	3.93

[1] Weight data not available.

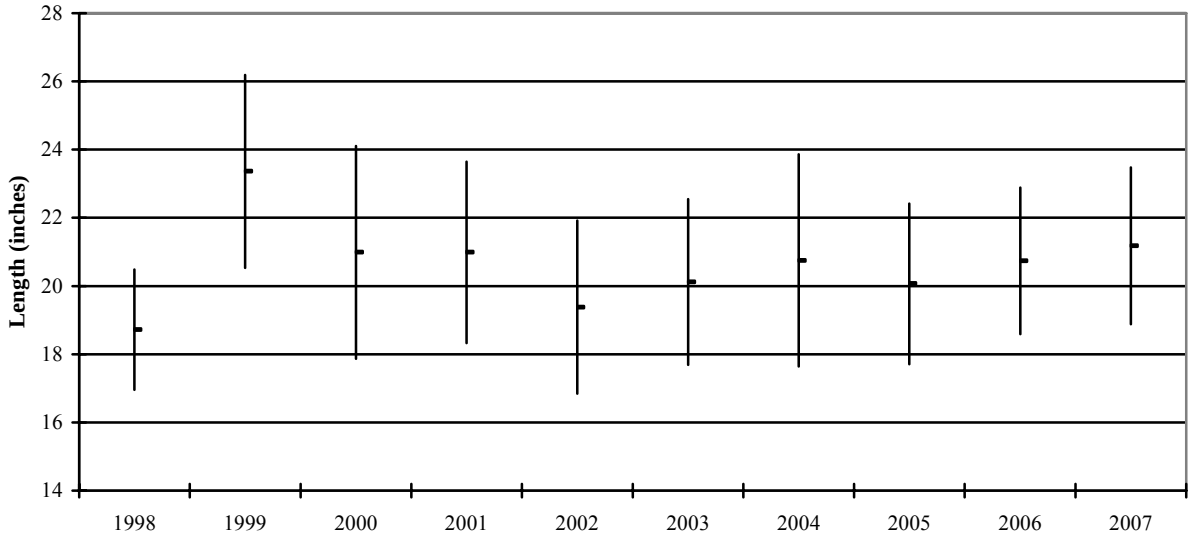
Appendix III *continued*. Average length and weight of salmonine species and yellow perch, observed from the Indiana Department of Natural Resources Lake Michigan creel survey during 1998 through 2007. Data from boat, shore, and stream fisheries combined. std. = standard deviation.

Year	Average length (in)	std.	Average weight (lb)	std.
Lake Trout				
1998[1]	28.9 (n=430)	4.32	---	---
1999[1]	26.5 (n=63)	3.42	---	---
2000	27.0 (n=114)	2.84	7.27 (n=114)	2.64
2001	26.3 (n=124)	2.56	7.10 (n=123)	2.35
2002	27.0 (n=65)	3.17	7.57 (n=64)	2.96
2003	26.5 (n=27)	2.14	6.78 (n=27)	1.61
2004	26.8 (n=41)	3.10	7.54 (n=41)	2.92
2005	26.8 (n=79)	3.28	7.75 (n=79)	3.03
2006	25.6 (n=62)	2.43	6.55 (n=62)	2.28
2007	26.9 (n=172)	3.01	7.30 (n=171)	2.54
Steelhead trout				
1998[1]	26.6 (n=870)	3.96	---	---
1999[1]	29.3 (n=606)	3.34	---	---
2000	28.3 (n=296)	4.31	8.41 (n=287)	3.43
2001	27.6 (n=503)	3.17	7.76 (n=494)	2.61
2002	29.2 (n=481)	3.39	8.67 (n=477)	2.68
2003	25.6 (n=318)	4.38	6.50 (n=318)	3.16
2004	27.7 (n=278)	3.70	8.16 (n=278)	2.80
2005	26.7 (n=325)	3.75	6.74 (n=324)	2.75
2006	27.6 (n=321)	3.43	7.63 (n=321)	2.66
2007	26.0 (n=266)	4.88	6.77 (n=265)	3.30
Yellow perch				
1998[1]	10.3 (n=783)	1.26	---	---
1999[1]	9.85 (n=2,150)	1.73	---	---
2000[1]	10.4 (n=930)	1.78	---	---
2001	10.4 (n=891)	2.10	0.50 (n=809)	0.34
2002	9.69 (n=904)	1.74	0.46 (n=894)	0.34
2003	10.0 (n=1,489)	1.67	0.50 (n=1,488)	0.29
2004	9.53 (n=901)	1.75	0.45 (n=889)	0.29
2005	10.4 (n=808)	1.79	0.56 (n=803)	0.32
2006	9.51 (n=878)	1.45	0.42 (n=878)	0.22
2007	10.7 (n=265)	1.48	0.55 (n=265)	0.25

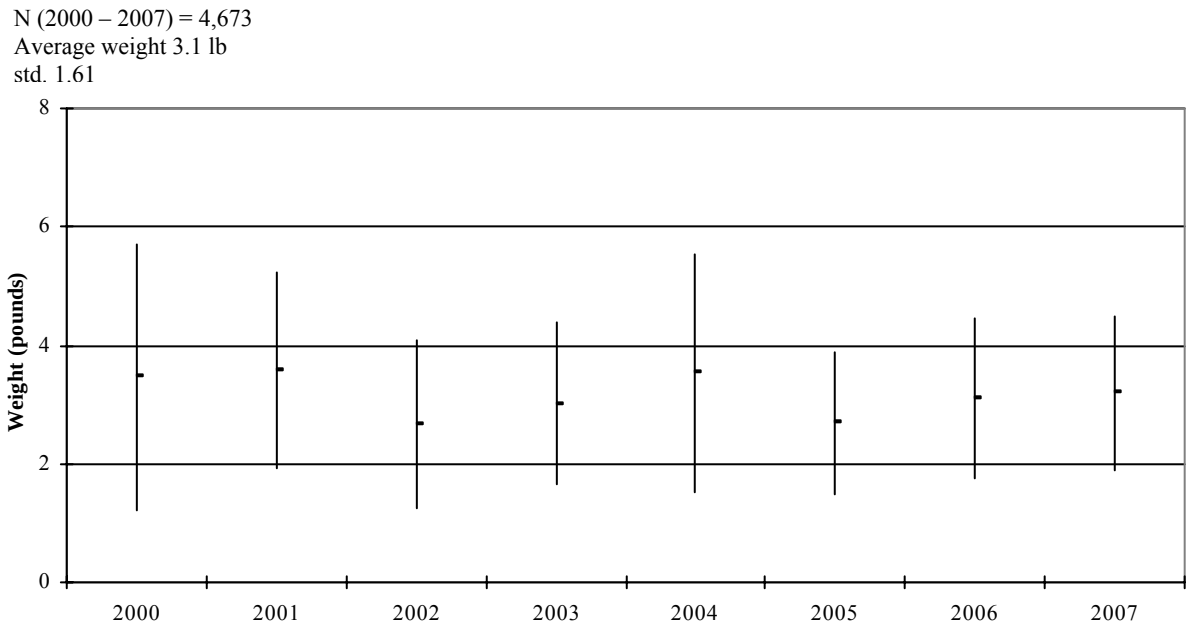
[1] Weight data not available.



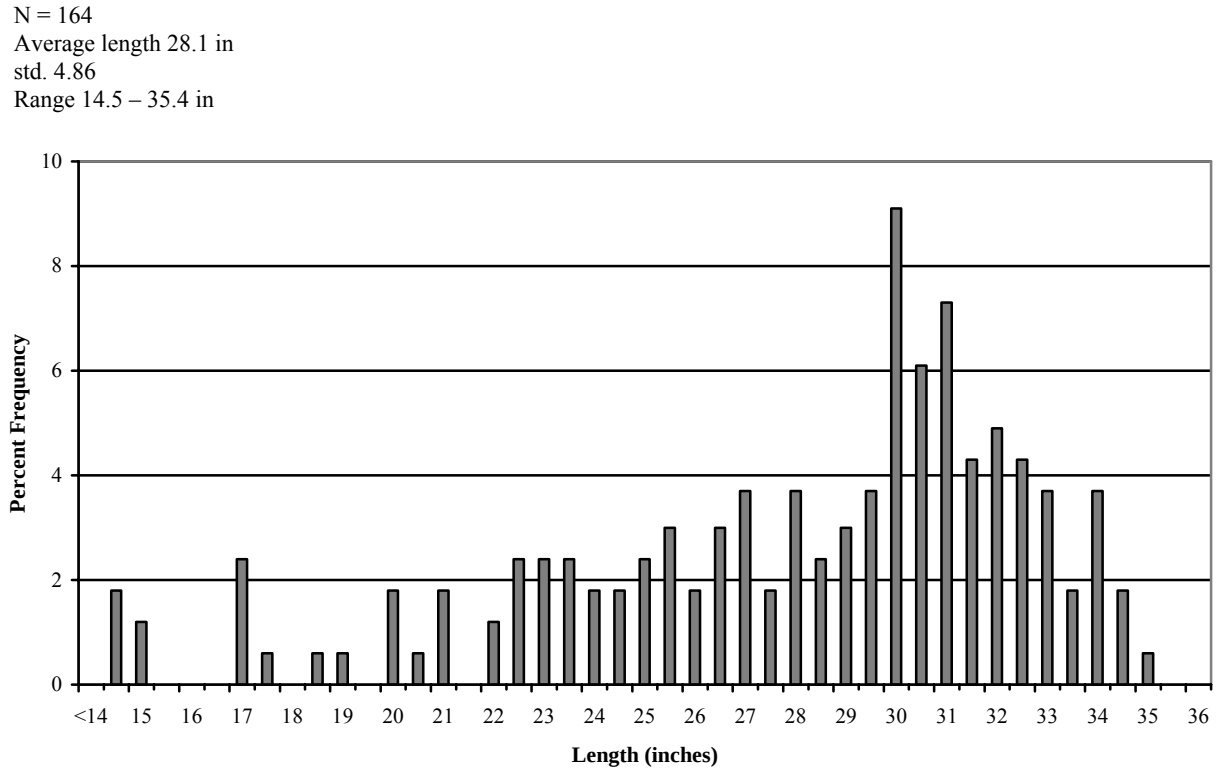
Appendix IV (a). Length frequency of coho salmon observed in the Indiana Department of Natural Resources Lake Michigan creel survey during 2007.



Appendix IV (b). Average total length of creeled coho salmon from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007.

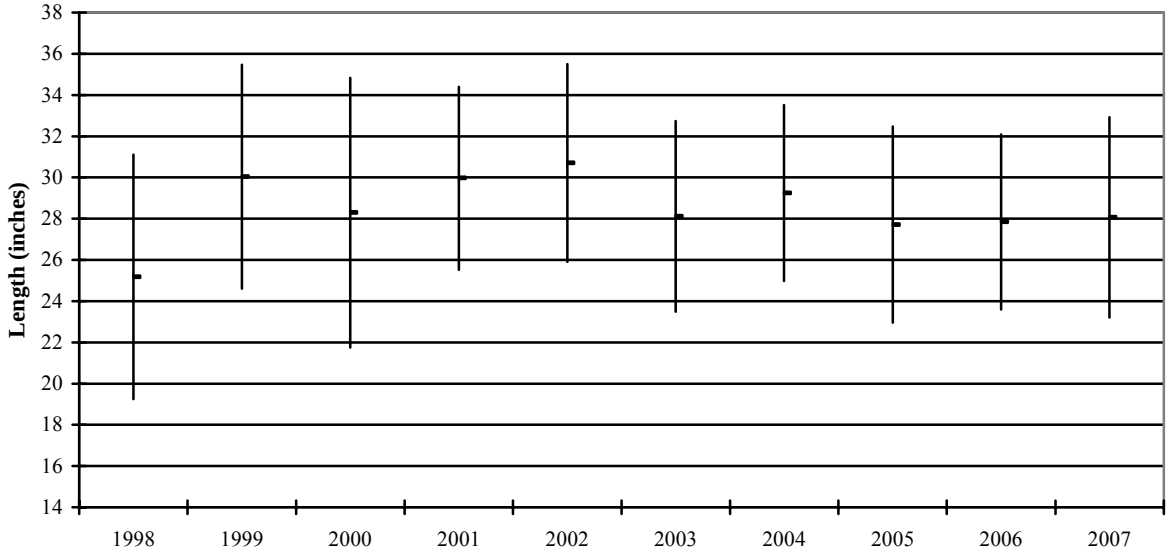


Appendix IV (c). Average weight of creeled coho salmon from the Indiana Department of Natural Resources Lake Michigan creel survey, 2000 through 2007.



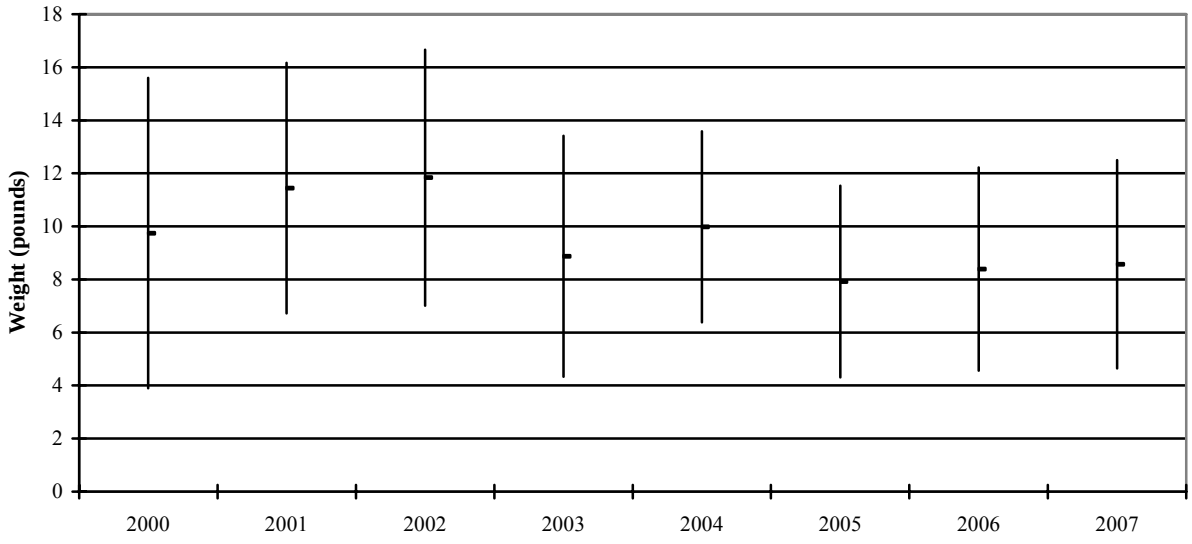
Appendix V (a). Length frequency of Chinook salmon observed in the Indiana Department of Natural Resources Lake Michigan creel survey during 2007.

N (1998 – 2007) = 3,208
Average length 28.9 in
std. = 5.18

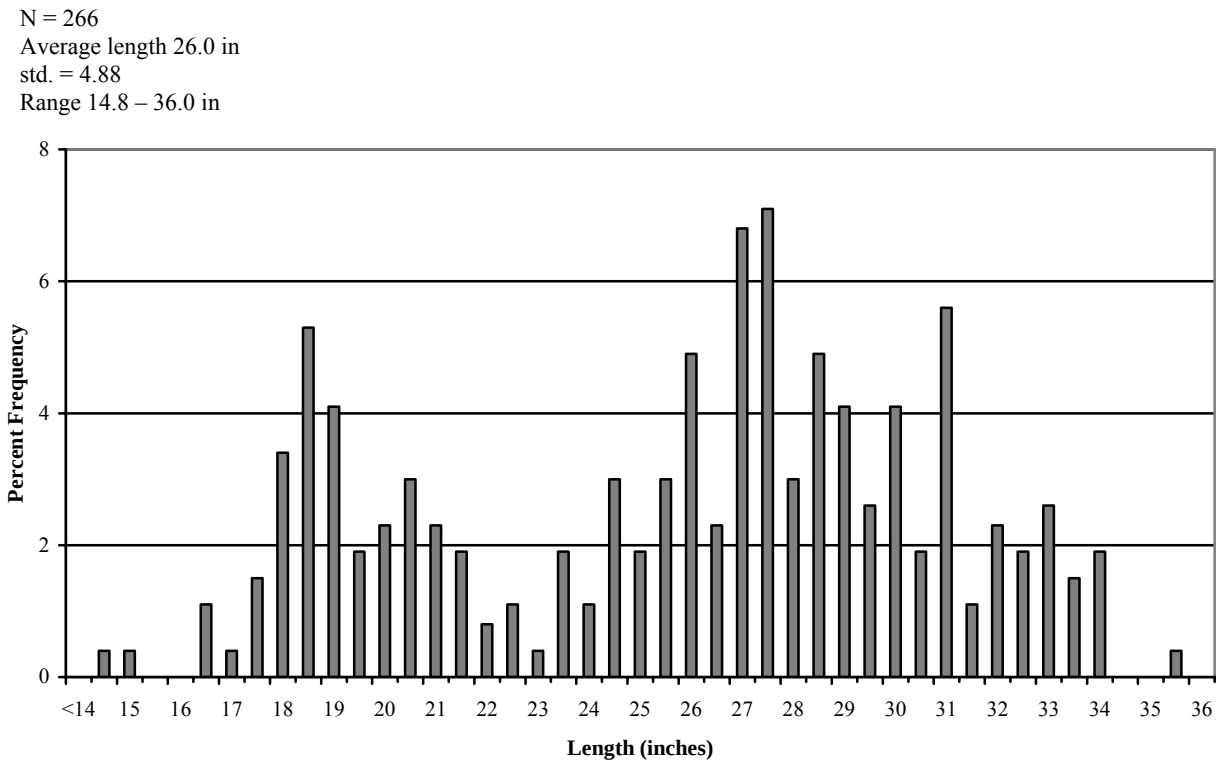


Appendix V (b). Average total length of creeled Chinook salmon from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007.

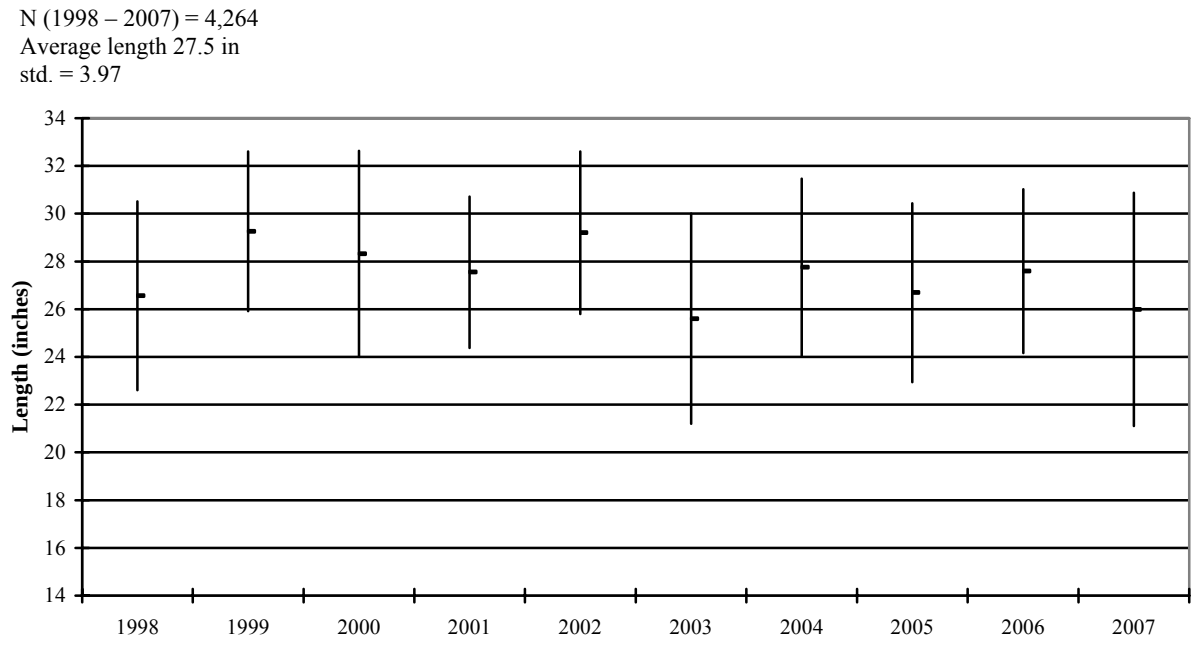
N (2000 – 2007) = 2,686
Average weight 9.9 lb
std. = 4.67



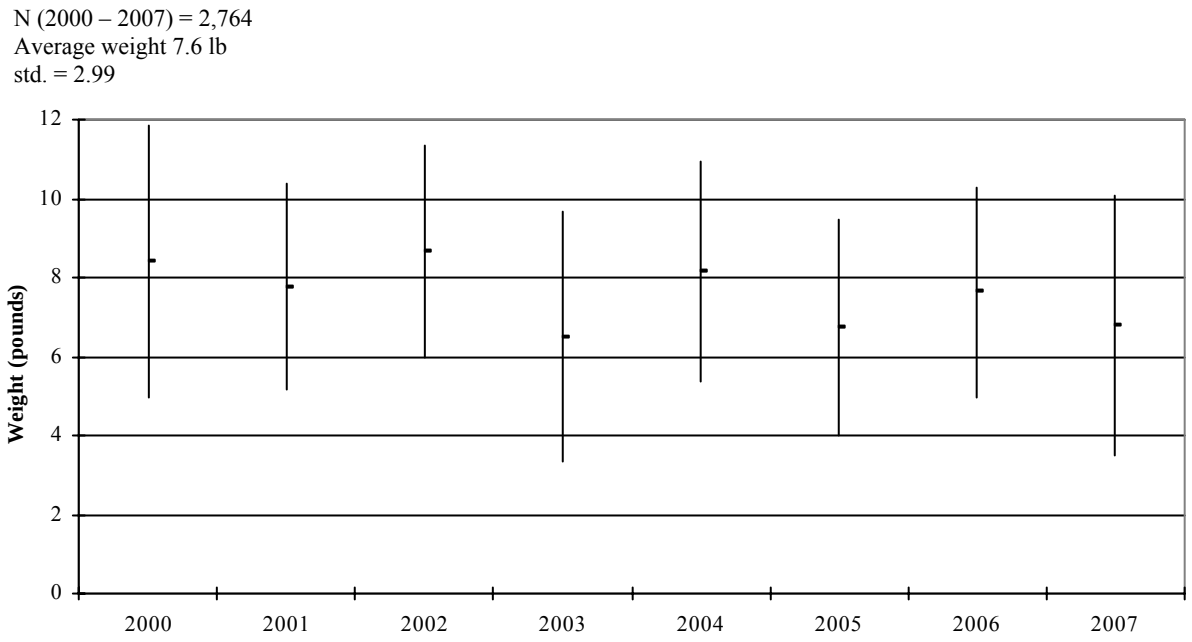
Appendix V (c). Average weight of creeled Chinook salmon from the Indiana Department of Natural Resources Lake Michigan creel survey, 2000 through 2007.



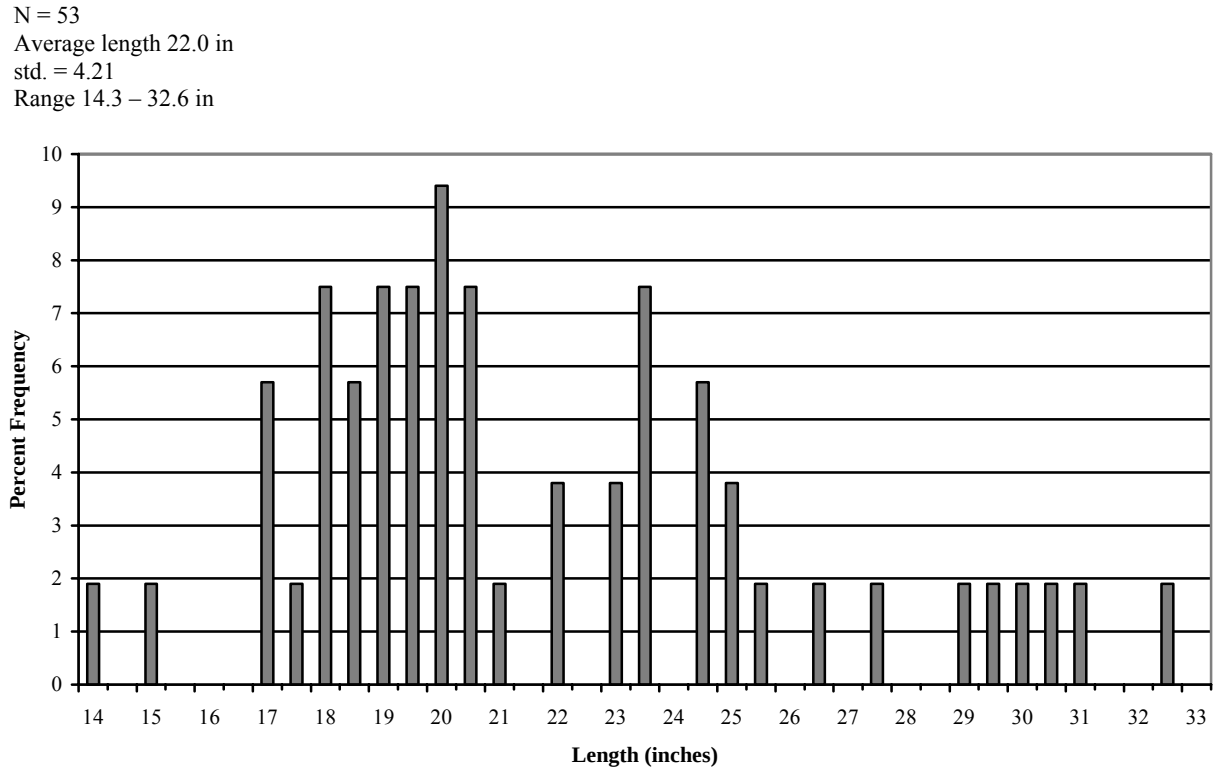
Appendix VI (a). Length frequency of steelhead observed in the Indiana Department of Natural Resources Lake Michigan creel survey during 2007.



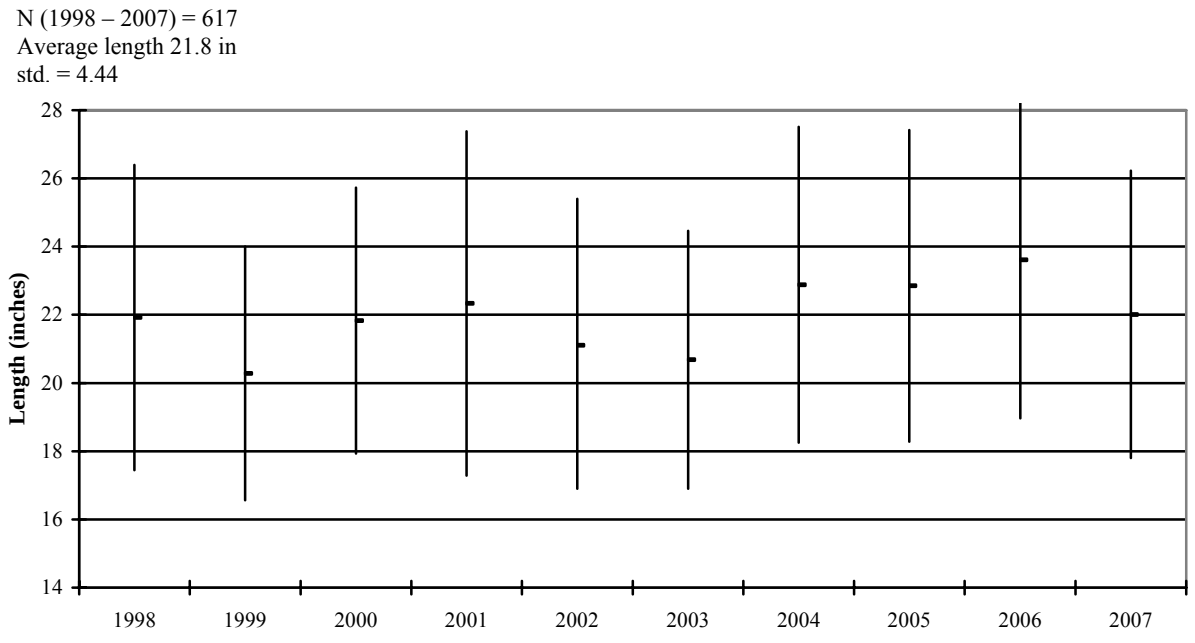
Appendix VI (b). Average total length of creeled steelhead from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007.



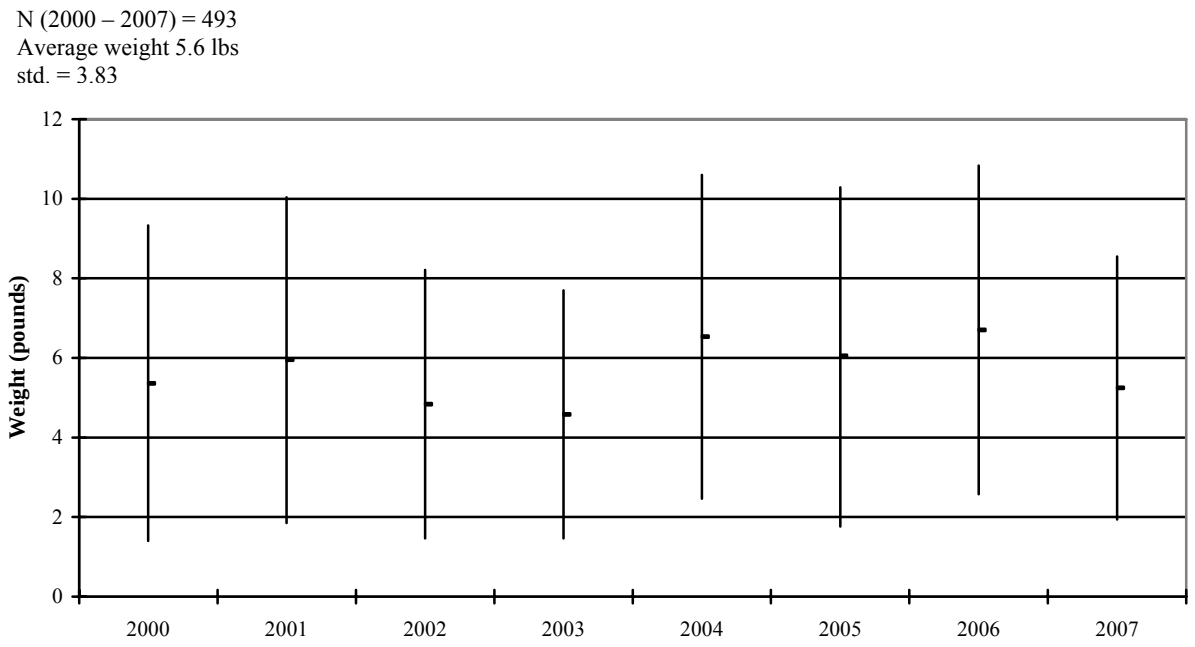
Appendix VI (c). Average weight of creeled steelhead from the Indiana Department of Natural Resources Lake Michigan creel survey, 2000 through 2007.



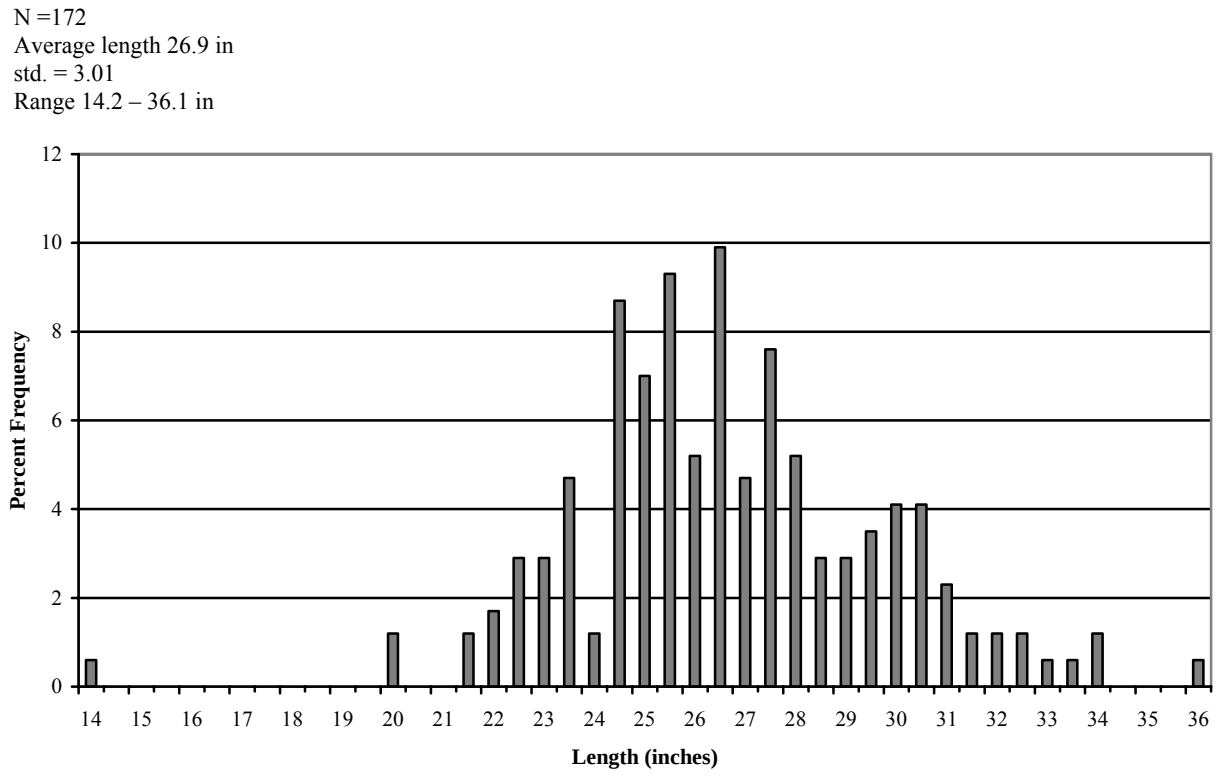
Appendix VII (a). Length frequency of brown trout observed in the Indiana Department of Natural Resources Lake Michigan creel survey during 2007.



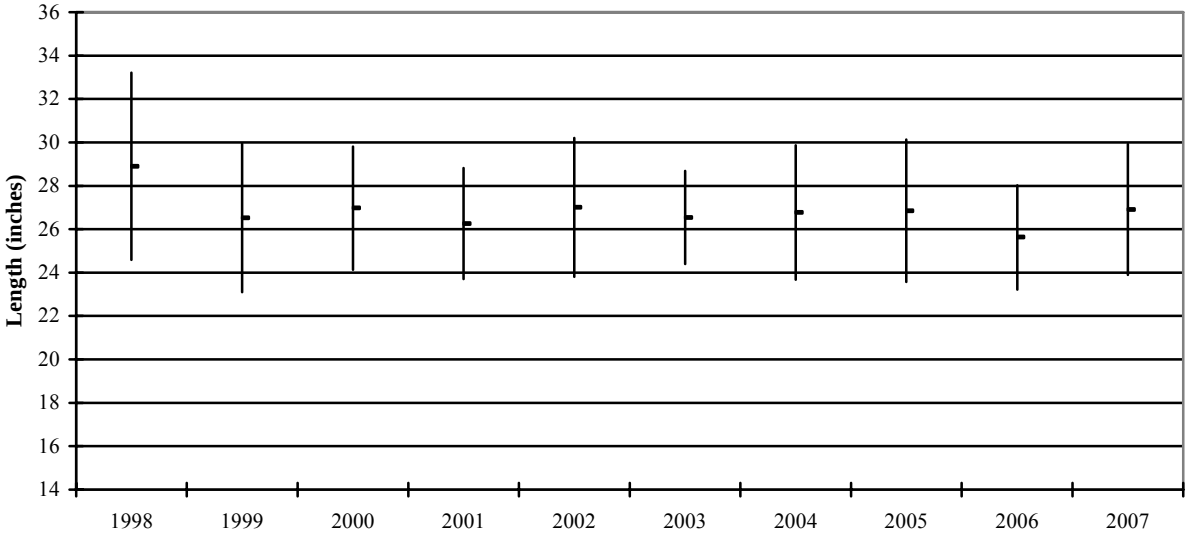
Appendix VII (b). Average total length of creeled brown trout from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007.



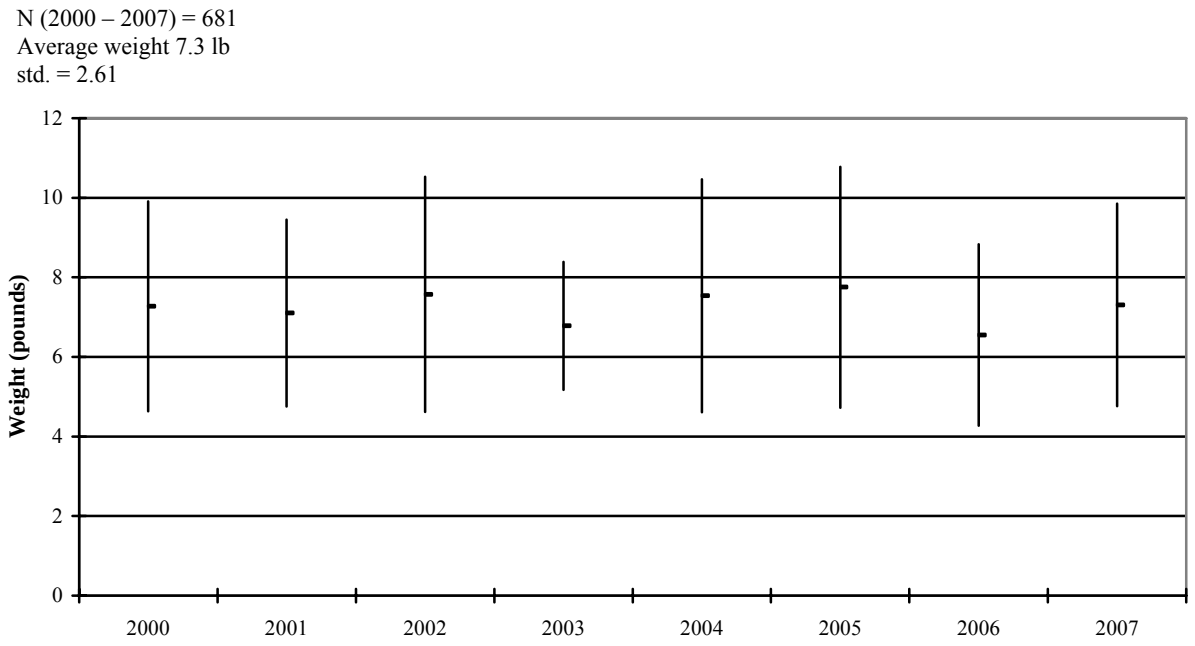
Appendix VII (c). Average weight of creeled brown trout from the Indiana Department of Natural Resources Lake Michigan creel survey, 2000 through 2007.



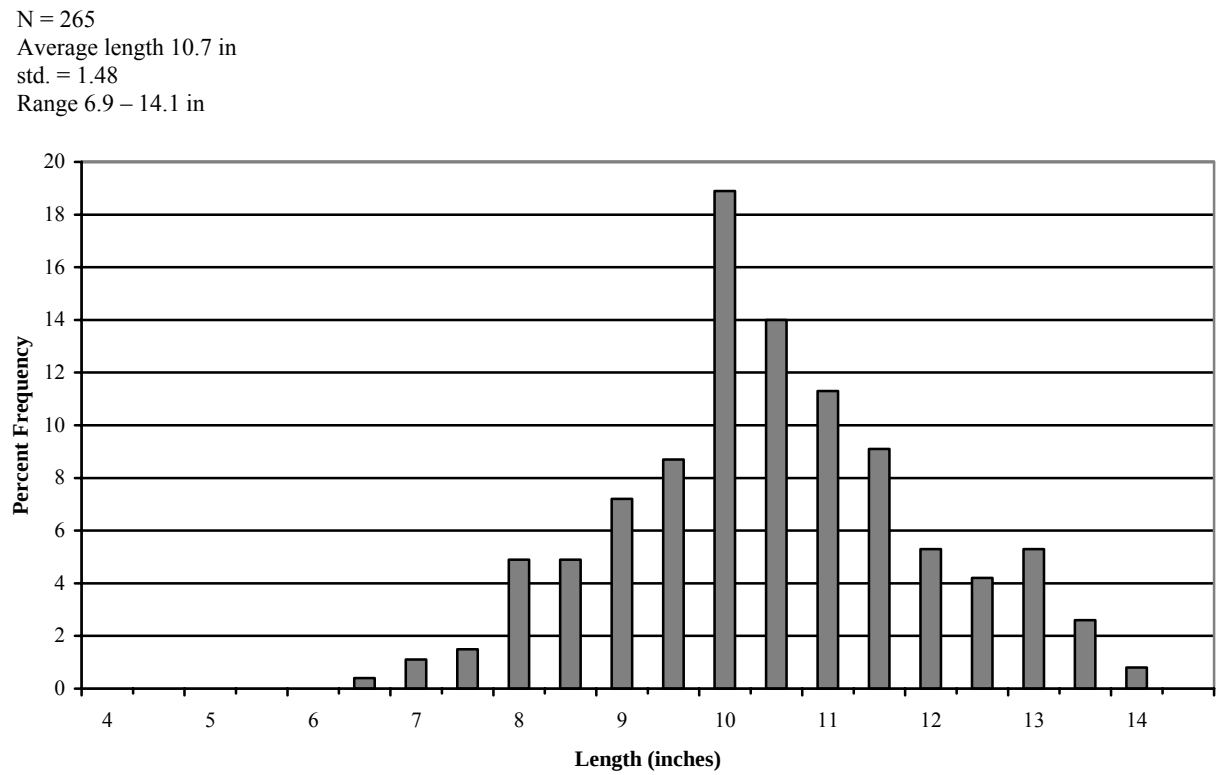
Appendix VIII (a). Length frequency of lake trout observed in the Indiana Department of Natural Resources Lake Michigan creel survey during 2007.



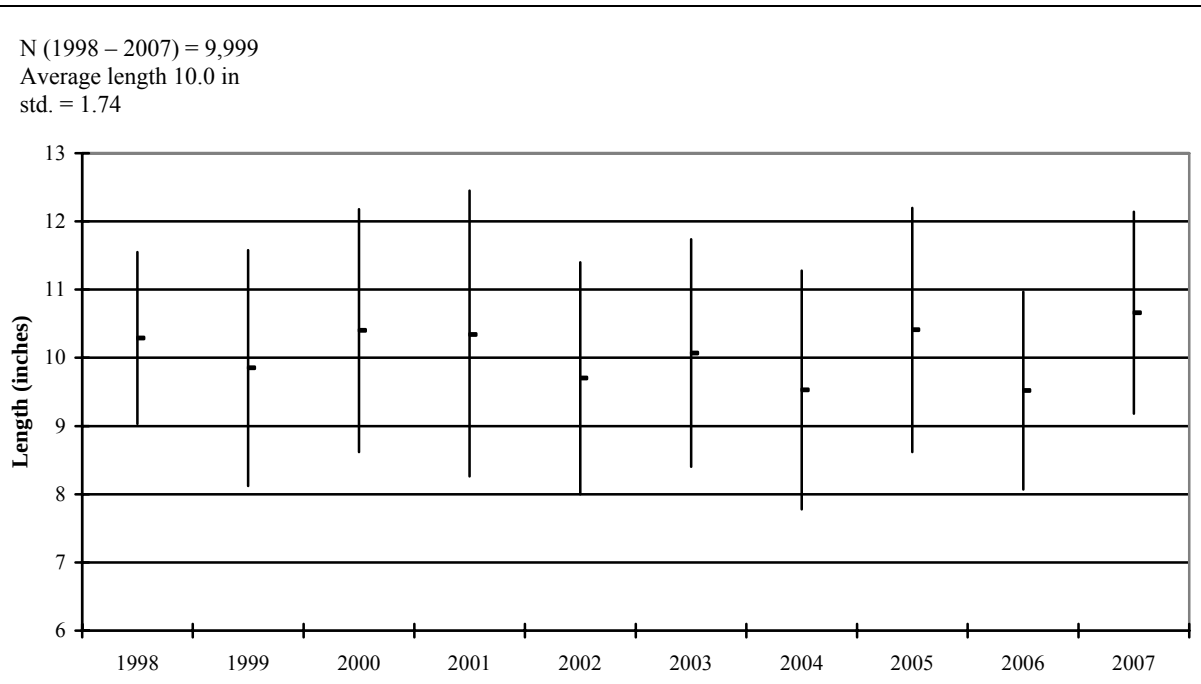
Appendix VIII (b). Average total length of creeled lake trout from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007.



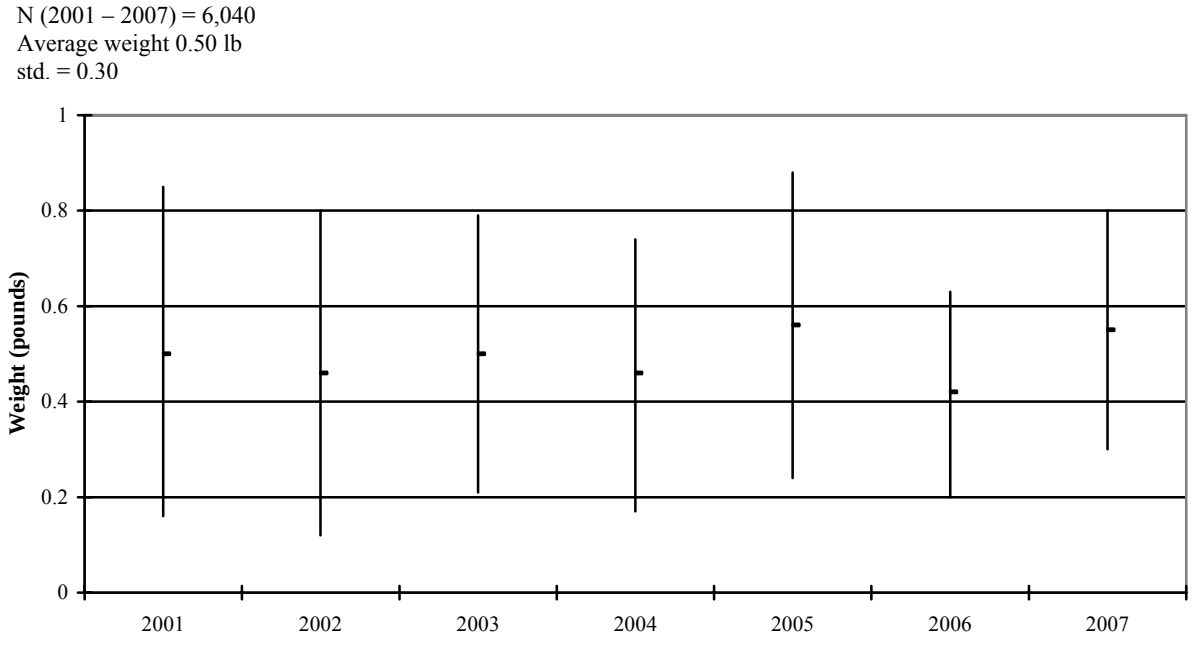
Appendix VIII (c). Average weight of creeled lake trout from the Indiana Department of Natural Resources Lake Michigan creel survey, 2000 through 2007.



Appendix IX (a). Length frequency of yellow perch observed in the Indiana Department of Natural Resources Lake Michigan creel survey during 2007.



Appendix IX (b). Average total length of creeled yellow perch from the Indiana Department of Natural Resources Lake Michigan creel survey, 1998 through 2007.



Appendix IX (c). Average weight of creeled yellow perch from the Indiana Department of Natural Resources Lake Michigan creel survey, 2001 through 2007.

Appendix X (a). County of residence of anglers that were surveyed in the Indiana Department of Natural Resources Lake Michigan creel survey fishing from boat during 2007 (n=866).

County	No. Parties	%	County	No. Parties	%
Lake	338	(39.0)	Howard	1	(0.1)
Out-of-State	173	(20.0)	Jay	1	(0.1)
Porter	139	(16.0)	Marshall	1	(0.1)
LaPorte	125	(14.4)	Martin	1	(0.1)
St. Joseph	17	(2.0)	Miami	1	(0.1)
Jasper	7	(0.8)	Pulaski	1	(0.1)
Kosciusko	7	(0.8)	Putnam	1	(0.1)
Marion	6	(0.7)	Tipton	1	(0.1)
Starke	6	(0.7)	Wells	1	(0.1)
Allen	5	(0.6)			
Elkhart	5	(0.6)			
Tippecanoe	4	(0.5)			
Noble	3	(0.4)			
Parke	3	(0.4)			
Wayne	3	(0.4)			
Grant	2	(0.2)			
Morgan	2	(0.2)			
Newton	2	(0.2)			
Wabash	2	(0.2)			
Benton	1	(0.1)			
Boone	1	(0.1)			
Brown	1	(0.1)			
Clark	1	(0.1)			
DeKalb	1	(0.1)			
Hamilton	1	(0.1)			
Hancock	1	(0.1)			
Hendricks	1	(0.1)			

Appendix X (b). County of residence of anglers that were surveyed in the Indiana Department of Natural Resources Lake Michigan creel survey fishing from shore during 2007 (n=1,119).

County	No. Parties	%	County	No. Parties	%
Lake	343	(30.6)	Carroll	1	(0.1)
LaPorte	316	(28.2)	Hancock	1	(0.1)
Porter	220	(19.7)	Henry	1	(0.1)
Out-of-State	99	(8.8)	Howard	1	(0.1)
St. Joseph	29	(2.6)	Johnson	1	(0.1)
Elkhart	20	(1.8)	Marshall	1	(0.1)
Allen	11	(1.0)	Morgan	1	(0.1)
Marion	11	(1.0)	Orange	1	(0.1)
Hamilton	6	(0.5)	Perry	1	(0.1)
Kosciusko	5	(0.4)	Rush	1	(0.1)
Wayne	5	(0.4)	Tipton	1	(0.1)
Grant	4	(0.4)	Washington	1	(0.1)
Miami	4	(0.4)	Wells	1	(0.1)
Wabash	4	(0.4)			
Clinton	3	(0.3)			
Jasper	3	(0.3)			
Putnam	3	(0.3)			
White	3	(0.3)			
Cass	2	(0.2)			
Delaware	2	(0.2)			
Fulton	2	(0.2)			
Hendricks	2	(0.2)			
Martin	2	(0.2)			
Newton	2	(0.2)			
Starke	2	(0.2)			
Vigo	2	(0.2)			
Brown	1	(0.1)			

Appendix X (c). County of residence of anglers that were surveyed in the Indiana Department of Natural Resources Lake Michigan creel survey fishing from stream during 2007 (n=849).

County	No. Parties	%	County	No. Parties	%
LaPorte	207	(24.4)	Wabash	3	(0.4)
Out-of-State	188	(22.1)	Bartholomew	2	(0.2)
Porter	136	(16.0)	Cass	2	(0.2)
Lake	64	(7.5)	Clinton	2	(0.2)
St. Joseph	58	(6.8)	Hamilton	2	(0.2)
Elkhart	25	(2.9)	Hendricks	2	(0.2)
Allen	15	(1.8)	Jennings	2	(0.2)
Kosciusko	15	(1.8)	LaGrange	2	(0.2)
Marion	13	(1.5)	White	2	(0.2)
Tippecanoe	11	(1.3)	Whitley	2	(0.2)
Marshall	9	(1.1)	Dubois	1	(0.1)
Delaware	8	(1.0)	Greene	1	(0.1)
Grant	6	(0.7)	Hancock	1	(0.1)
DeKalb	5	(0.6)	Jackson	1	(0.1)
Miami	5	(0.6)	Jay	1	(0.1)
Wayne	5	(0.6)	Newton	1	(0.1)
Howard	4	(0.5)	Orange	1	(0.1)
Jasper	4	(0.5)	Parke	1	(0.1)
Noble	4	(0.5)	Putnam	1	(0.1)
Starke	4	(0.5)	Vigo	1	(0.1)
Warrick	4	(0.5)	Wells	1	(0.1)
Adams	3	(0.4)			
Fayette	3	(0.4)			
Fulton	3	(0.4)			
Huntington	3	(0.4)			
Madison	3	(0.4)			
Monroe	3	(0.4)			
Morgan	3	(0.4)			
Pulaski	3	(0.4)			
Vanderburgh	3	(0.4)			

Appendix XI (a). Boat, shore and stream angler response to the species importance and species satisfaction questions from the Indiana Department of Natural Resources Lake Michigan creel survey, 2007.

	Importance						Satisfaction					
Species	5	4	3	2	1	n/a	5	4	3	2	1	n/a
Coho	560(87%)	47(7%)	22(3%)	6(<1%)	6(<1%)	4(<1%)	176(27%)	156(24%)	151(24%)	59(9%)	33(5%)	64(10%)
Chinook	591(89%)	34(5%)	26(4%)	5(<1%)	4(<1%)	3(<1%)	150(23%)	206(31%)	148(23%)	58(9%)	34(5%)	59(9%)
Steelhead	1,095(94%)	39(3%)	24(2%)	2(<1%)	4(<1%)	5(<1%)	417(36%)	310(27%)	232(20%)	54(5%)	27(2%)	119(10%)
Brown Trout	335(82%)	22(5%)	29(7%)	7(2%)	11(3%)	3(<1%)	65(16%)	46(11%)	81(20%)	57(14%)	84(21%)	68(17%)
Lake Trout	58(65%)	5(6%)	11(12%)	6(7%)	7(8%)	2(2%)	28(31%)	17(19%)	20(22%)	9(10%)	12(13%)	3(3%)
Yellow Perch	651(98%)	7(1%)	7(1%)	1(<1%)	0	1(<1%)	186(28%)	219(33%)	193(29%)	32(5%)	13(2%)	18(3%)

Appendix XI (b). Boat angler response to the species importance and species satisfaction questions from the Indiana Department of Natural Resources Lake Michigan creel survey, 2007.

	Importance						Satisfaction					
Species	5	4	3	2	1	n/a	5	4	3	2	1	n/a
Coho	208(92%)	16(7%)	3(1%)	0	0	0	90(40%)	57(25%)	49(22%)	16(7%)	12(5%)	1(<1%)
Chinook	204(95%)	6(3%)	4(2%)	0	0	0	55(26%)	96(45%)	41(19%)	12(6%)	6(3%)	1(<1%)
Steelhead	85(93%)	2(2%)	3(3%)	0	1(1%)	0	28(31%)	18(20%)	23(25%)	12(13%)	8(9%)	2(2%)
Brown Trout	58(80%)	6(8%)	3(4%)	2(3%)	3(4%)	0	24(33%)	9(12%)	16(22%)	12(17%)	10(14%)	1(1%)
Lake Trout	53(67%)	5(6%)	9(11%)	5(6%)	5(6%)	2(2%)	25(32%)	17(21%)	19(24%)	9(11%)	7(9%)	2(2%)
Yellow Perch	349(98%)	3(<1%)	2(<1%)	1(<1%)	0	0	120(34%)	144(41%)	74(21%)	5(1%)	3(<1%)	6(2%)

Appendix XI (c). Shore angler response to the species importance and species satisfaction questions from the Indiana Department of Natural Resources Lake Michigan creel survey, 2007.

	Importance						Satisfaction					
Species	5	4	3	2	1	n/a	5	4	3	2	1	n/a
Coho	83(88%)	7(7%)	2(2%)	0	1(1%)	1(1%)	28(30%)	20(21%)	24(25%)	14(15%)	3(3%)	5(5%)
Chinook	123(88%)	10(7%)	6(4%)	0	0	0	30(22%)	46(33%)	44(32%)	10(7%)	9(6%)	0
Steelhead	317(93%)	12(3%)	11(3%)	0	1(<1%)	1(<1%)	118(35%)	97(29%)	86(25%)	16(5%)	10(3%)	12(3%)
Brown Trout	37(80%)	4(9%)	3(6%)	2(4%)	0	0	15(33%)	6(13%)	8(17%)	8(17%)	6(13%)	3(6%)
Lake Trout	5(50%)	0	2(20%)	1(10%)	2(20%)	0	3(30%)	0	1(10%)	0	5(50%)	1(10%)
Yellow Perch	299(97%)	4(1%)	5(2%)	0	0	1(<1%)	66(22%)	74(24%)	117(38%)	27(9%)	10(3%)	12(4%)

Appendix XI (d). Stream angler response to the species importance and species satisfaction questions from the Indiana Department of Natural Resources Lake Michigan creel survey, 2007.

	Importance						Satisfaction					
Species	5	4	3	2	1	n/a	5	4	3	2	1	n/a
Coho	269(83%)	24(7%)	17(5%)	6(2%)	5(1%)	3(<1%)	58(18%)	79(25%)	78(24%)	29(9%)	18(6%)	58(18%)
Chinook	264(85%)	18(6%)	16(5%)	5(2%)	4(1%)	3(1%)	65(21%)	64(21%)	63(21%)	36(12%)	19(6%)	58(19%)
Steelhead	693(94%)	25(3%)	10(1%)	2(<1%)	2(<1%)	4(<1%)	271(37%)	195(27%)	123(17%)	26(4%)	9(1%)	105(14%)
Brown Trout	240(83%)	12(4%)	23(8%)	3(1%)	8(3%)	3(1%)	26(9%)	31(11%)	57(20%)	37(13%)	68(24%)	64(23%)
Lake Trout	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Perch	3(100%)	0	0	0	0	0	0	1(33%)	2(67%)	0	0	0